RECORD OF DECISION
for きょう
OPERABLE UNIT 2
FORT WAINWRIGHT
FAIRBANKS, ALASKA

1/97

January 1997



DECLARATION STATEMENT

for RECORD OF DECISION FORT WAINWRIGHT FAIRBANKS, ALASKA OPERABLE UNIT 2 JANUARY 1997

SOURCE AREA NAME AND LOCATION

Operable Unit 2 Fort Wainwright Fairbanks, Alaska

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the selected remedial actions for Operable Unit 2 (OU-2) at Fort Wainwright in Fairbanks, Alaska. OU-2 originally consisted of eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites. This ROD was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 and 42 United States Code 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan and 40 Code of Federal Regulations 300 et seq. This decision is based on the Administrative Record for this OU.

The United States Army, the United States Environmental Protection Agency, and the State of Alaska, through the Alaska Department of Environmental Conservation, have agreed to the selected remedies.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed by implementing the response actions selected in this ROD, may present a substantial endangerment to public health, welfare, or the environment. Specific hazardous substances in the soil and groundwater at the DRMO Yard and Building 1168 Leach Well include benzene, tetrachloroethene, trichloroethene, and petroleum by-products.

DESCRIPTION OF THE SELECTED REMEDIES

This is the third OU to reach a final-action ROD at this National Priorities List site. This ROD addresses soil and groundwater contamination at OU-2.

The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to the Fort Wainwright OU-1 investigation and will be addressed through the

OU-1 decision process. No further action is selected for Building 3477 and the Tar Sites. The contaminated soils at the North Post Site were addressed adequately through an Army removal action; it is anticipated that this will constitute final action for the North Post Site. Therefore, no analysis of remedial alternatives was conducted for these source areas. The documents recommending these actions are included in Appendix A.

The remedial action objectives for the DRMO Yard and Building 1168 Leach Well are designed to:

- Restore groundwater to drinking water quality;
- Prevent further leaching of contaminants into groundwater;
- Reduce or prevent further off-site migration of contaminated groundwater; and
- Prevent use of groundwater above federal Safe Drinking Water Act and State of Alaska Drinking Water Standards (18 Alaska Administrative Code 80) maximum contaminant levels (MCLs).

The major components of the remedies at both source areas are:

- In situ soil vapor extraction and air sparging of the groundwater to reduce volatile organic compounds to a level that meets state and federal MCLs;
- Institutional controls that would include restrictions on groundwater well installations, site access restrictions, and maintenance of fencing at the DRMO Yard until state and federal MCLs are met;
- Additional institutional controls, including a limitation on refilling the DRMO Yard fire suppression water tank from the existing potable water supply well, until state and federal MCLs are met (except in emergency situations); and
- Natural attenuation to attain Alaska Water Quality Standards after reaching state and federal MCLs.

STATUTORY DETERMINATION

The selected remedial actions are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial actions, and are cost-effective.

The remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfy the statutory preference for remedies that employ

treatment that reduces toxicity, mobility, or volume (of contaminated media) as a principal element.

Because these remedies will result in hazardous substances at concentrations remaining above regulatory levels at these source areas, a policy review will be conducted within five years after commencement of the remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

WILLIAM M. STEELE Lieutenant General, USA

Commanding

Date

27 March 1994

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

Chuck Clarke

3-31-97

Date

Regional Administrator, Region 10

United States Environmental Protection Agency

SIGNATURES

Signature sheet for the foregoing Operable Unit 2, Fort Wainwright, Record of Decision between the United States Army and United States Environmental Protection Agency, Region 10, with concurrence by the Alaska Department of Environmental Conservation.

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Kurt Fredriksson

Director, Spill Prevention and Response Alaska Department of Environmental Conservation Date

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DECISION SUMMARY

RECORD OF DECISION
for
OPERABLE UNIT 2
FORT WAINWRIGHT
FAIRBANKS, ALASKA
JANUARY 1997

This decision summary provides an overview of the problems posed by the contaminants at Fort Wainwright, Operable Unit 2 (OU-2), source areas. This summary describes the physical features of the site, the contaminants present, and the associated risks to human health and the environment. The summary also describes the remedial alternatives considered; provides the rationale for the remedial actions selected; and states how the remedial actions satisfy the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) statutory requirements.

The United States Army (Army) completed a Remedial Investigation (RI) to provide information regarding the nature and extent of contamination in the soils and groundwater. A Baseline Human Health and Ecological Risk Assessment was developed and used in conjunction with the RI to determine the need for remedial action and to aid in the selection of remedies. A Feasibility Study (FS) was completed to evaluate remedial options.

1.0 SITE DESCRIPTION

1.1 SITE LOCATION AND DESCRIPTION

Fort Wainwright, also referred to as *the site*, occupies 915,000 acres on the east side of Fairbanks, Alaska. Fort Wainwright originally was established in 1938 as a cold weather testing station. During World War II, it served as a crew transfer point in the United States-Soviet Union Lend-Lease Program. After the war, it became a resupply and maintenance base for remote experimental stations in the Arctic Ocean and remote Distant Early Warning sites throughout Alaska. In 1961, Fort Wainwright was transferred to the Army.

Current primary missions at Fort Wainwright include training of infantry soldiers in the arctic environment, testing of equipment in arctic conditions, preparation of troops for defense of the Pacific Rim, and rapid deployment of troops worldwide. On-site industrial activities include use and maintenance of fixed-wing aircraft, helicopters, vehicles, and support activities. Fort Wainwright includes the main post area, two range complexes, and two maneuver areas.

OU-2 originally consisted of the following eight source areas: the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, four Tar Sites, the Defense Reutilization and Marketing Office (DRMO) Yard, and the Building 1168 Leach Well. All OU-2 source areas have undergone Preliminary Source Evaluations, which include historical record reviews and, if necessary, limited field investigations. These investigations determined whether a source area should be referred to another federal or state program or another OU, recommended for no further action (NFA), or included in the CERCLA remedial investigation. Petroleum contamination can be addressed in the Two-Party Agreement between the State of Alaska and the Army.

The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. Figure 1-1 illustrates the entire installation and each source area's location. All source areas are in a 500-year floodplain, except for the North Post and Engineers Park Drum Sites, which are in the 100-year floodplain. No threatened or endangered species reside in the area. Small ponds and wetlands are adjacent to the DRMO Yard. No known historic sites are associated with the source areas.

1.1.1 801 Drum Burial Site

The 801 Drum Burial Site is in an undeveloped depression between River Road and the Chena River, approximately 0.13 mile east of the 801 military housing area. This source area is shown in Figure 1-1.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the 801 Drum Burial Site source area will not be discussed further in this Record of Decision (ROD).

1.1.2 Engineers Park Drum Site

The source area location is shown in Figure 1-1. The Engineers Park Drum Site is located on the northeast side of Engineers Park, on the south bank of the Chena River. Drum disposal reportedly began at this source area after the 1967 Chena River flood.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Engineers Park Drum Site source area will not be discussed further in this ROD.

1.1.3 Drum Site South of the Landfill

The Drum Site South of the Landfill is located 2,000 feet south of the Fort Wainwright Landfill, as shown in Figure 1-1. Historical information and records regarding drum disposal at this source area are not available. This site was identified as a potential source in the Resource Conservation and Recovery Act (RCRA) Facility Assessment conducted in 1988.

This source area was assigned to the Fort Wainwright OU-1 investigation and will be addressed through the OU-1 decision process. The decision document recommending this action is included in Appendix A. Therefore, the Drum Site South of the Landfill will not be discussed further in this ROD.

1.1.4 Building 3477

Building 3477 is located on Chippewa Avenue, approximately 0.25 mile northeast of the South Gate Road Gate House (see Figure 1-1). Building 3477 was constructed as a vehicle maintenance facility in 1955 and is being used for vehicle and equipment maintenance. Batteries were serviced and stored at the site for an unknown period of time. In 1990, the Army discontinued this practice and contracted for cleaning the battery service area. Storage of old batteries continued along the east side of the building until they were disposed of.

Site investigations that included sampling and analysis of soil and groundwater in 1992 indicated that the source area was no longer being used for battery storage. Concentrations of suspected contaminants were below the United States Environmental Protection Agency's (EPA's) Region 3 risk-based screening levels based on residential land use. EPA, Region 10, Supplemental Risk Assessment Guidance recommends use of EPA, Region 3, risk-based screening criteria.

NFA is recommended for Building 3477 under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Building 3477 source area will not be discussed further in this ROD.

1.1.5 Tar Sites

The Tar Sites are in four locations: west of the South Post soccer field, on Southgate Road on the former South Post parade field; at Glass Park next to Building 4040; northwest of the Post Golf Course on the north bank of the Chena River; and west of the Post Power Plant

cooling pond next to the railroad (see Figure 1-1). These locations generally are covered by soil and vegetation.

The Tar Sites reportedly were used as tar disposal areas. An investigation conducted in June and July 1992 indicated that the analyzed tar samples have no potential to leach to groundwater. These results indicate that the Tar Sites should be addressed as a solid waste or through recycling/reuse. NFA is recommended for the Tar Sites under CERCLA. This recommendation is recorded in the decision document included in Appendix A. The Tar Sites source area will not be discussed further in this ROD.

1.1.6 Defense Reutilization and Marketing Office Yard

A detailed map of the DRMO Yard source area is depicted in Figure 1-2. The DRMO Yard is located along Badger Road, northwest of Badger Road and the Richardson Highway. The DRMO Yard source area is a fenced compound covering approximately 25 acres and containing seven buildings. The DRMO Yard contains numerous aisles of surplus appliances, tires, transformers, and wire. In addition, it serves as the hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base. The yard's function is to store obsolete, surplus, unserviceable equipment and supplies for transfer to another authorized user, for public auctions, or for destruction and disposal. Historical records of DRMO Yard activities were not maintained routinely. The DRMO Yard operates as a storage facility in accordance with the Fort Wainwright RCRA Part B Permit.

Approximately 200 feet east of the DRMO Yard source area is the Arctic Surplus site, a privately owned facility and a CERCLA National Priorities List (NPL) site. Many items formerly stored at the DRMO Yard were sold to Arctic Surplus.

1.1.7 Building 1168 Leach Well

A detailed map of the Building 1168 Leach Well source area is depicted in Figure 1-3. Building 1168 is located on the north side of Trainor Gate Road, adjacent to the Trainor Gate entrance and within approximately 200 feet of the Post boundary to Fort Wainwright. The Building 1168 Leach Well source area is surrounded by fenced storage yards on the north and east and by unrestricted parking lots on the south and west. Building 1168 is a single-story, 65-foot by 95-foot, lube oil and vehicle storage facility, equipped with a 2,000-gallon heating oil tank and a septic system for sanitary waste. A 10,000-gallon aboveground storage tank (AST) was located inside the southeast corner of the building. In 1958, the tank was removed and the area was converted to a petroleum, oil, and lubricant (POL) laboratory. Five floor drains were located in the west half of the building and were used to drain into an oil/water separator that emptied into a 250-gallon underground storage tank (UST) and a leach well. During summer 1995, the floor drains were filled and the UST and leach well were removed completely from service.

1.1.8 North Post Site

A detailed map of the North Post Site is depicted in Figure 1-4. The North Post Site covers approximately 45 acres and is located northwest of and adjacent to two military housing areas, on an oxbow of the Chena River.

In 1947, the Arctic Aeromedical Laboratory (AAL) began operating on the northwest portion of the source area. The laboratory conducted cold adaptation and acclimatization experiments for 20 years. In 1967, the facility was closed. In addition to AAL, several temporary buildings and a radio transmitter were located in the vicinity. The transmitter was most likely a base radio station. Historical photographs show that a slough of the Chena River separated the North Post Site source area from the main Post. This slough apparently was filled with construction debris during the 1940s and early 1950s.

The North Post Site was discovered during a 1985 geotechnical investigation for construction of a proposed housing development. The drilling crew noticed strong odors in soil borings on the west side of the oxbow area. Additional soil borings and wells were drilled, and petroleum and solvents were identified in the west portion of the oxbow. Additional sampling and evaluation occurred in 1986 and 1987 to investigate and delineate areas of potential contamination. An endangerment assessment was conducted to evaluate whether hazardous wastes were present and whether they presented a threat to human health.

While most of the site was found to be free of contamination, fuels, solvents, pesticides, and metals were identified in discrete locations within this source area. Additional samples were collected at these sites to further characterize contamination and to evaluate levels for the Baseline Risk Assessment.

Petroleum-contaminated soil was removed and treated by the Army in 1993. In situ groundwater treatment continues at one of the source areas under the jurisdiction of the Two-Party Agreement between the State of Alaska and the Army. During summer 1996, the Army conducted an additional removal action that included excavation, treatment, and proper disposal of soils containing fuel-related products. This is anticipated to be the final action for this source area. The final report on this removal action may be found in Appendix A. Therefore, the North Post Site will not be discussed further in this ROD.

1.2 SOILS AND GEOLOGY

Fort Wainwright is underlain by soil and unconsolidated sediment that consist of silt, sand, and gravel and range in thickness from 10 feet to more than 400 feet before encountering bedrock. A 5-foot-thick surficial soil layer of fine-grained soil overlies the deeper alluvial deposits. The surficial soil consists of varying proportions of sand and gravel, which generally are layered. At the base of Birch Hill and in areas adjacent to the Chena River, soil types are coarse-grained and have high percentages of sand and gravel. Within the shallow alluvial aquifer, predominant groundwater flow beneath Fort Wainwright is toward the Chena River.

1.3 HYDROGEOLOGY AND GROUNDWATER USE

The main aquifer in the Fort Wainwright area is the Tanana Basin alluvial aquifer in a buried river valley. This aquifer ranges from a few feet thick at the base of Birch Hill to at least 300 feet thick under the fort's main cantonment area. The aquifer may reach a thickness of 700 feet in the Tanana River valley. Groundwater in the Tanana-Chena floodplain generally is considered to be unconfined in permafrost-free areas. A confined aquifer may develop seasonally where the depth to the water table is less than the depth of the seasonal frost

penetration. The depth to groundwater varies and may range from 2 feet to 18 feet below ground surface (BGS) at OU-2 source areas.

Groundwater movement between the Tanana and Chena Rivers generally follows a northwest regional direction, similar to the flow direction of the rivers. The Chena River flows through Fort Wainwright and the City of Fairbanks, into the Tanana River. The Tanana River borders the south portion of Fort Wainwright. Flow probes near OU-2 source areas indicate seasonal changes in flow direction of up to 180 degrees. This is because of the effects of changing river stages in the Tanana River and, to a lesser extent, in the Chena River. Groundwater levels near the Chena River fluctuate greatly because of river stage and interactions with the Tanana River. Typically, groundwater levels rise when the river stage increases, particularly during spring breakup and the late summer runoff. Groundwater levels usually drop during fall and winter, when precipitation becomes snow. During winter, groundwater seeps into surface water bodies, such as the Chena River, and produces overflow ice. In addition to shifts in the groundwater flow direction due to the surface water hydrology, the groundwater flow direction may be impacted by high-volume pumping at off-post gravel pits for dewatering activities.

Where present, permafrost forms discontinuous confining layers that influence groundwater movement and distribution. The depth to permafrost, when present, ranges from 2 feet to 40 feet BGS. The greater depths are found on cleared and developed land surfaces, where thermal degradation of underlying permafrost occurs.

Groundwater is the only source of potable water used at Fort Wainwright and the Fairbanks area. Approximately 95% of Fort Wainwright's potable water is supplied through a single distribution system which is normally fed by two large-capacity wells located in Building 3559, near the Post Power Plant (see Figure 1-5). These wells were completed at a depth of approximately 80 feet and provide between 1.5 million and 2.5 million gallons of water to the Post Water Treatment Plant for processing and distribution.

In addition to the main drinking water supply wells, there are five emergency standby supply wells located around the cantonment area. These wells have been completed between 80 feet and 120 feet and are capable of pumping approximately 250,000 gallons per day per well. These wells, if used in an emergency, will supply minimally treated water to Fort Wainwright's main drinking water supply system.

During summer 1996, a potable water supply/fire suppression well was installed in the DRMO Yard, 50 feet upgradient of the defined solvent plume and 100 feet downgradient of a defined petroleum plume. Associated with the fire suppression system is a 400,000-gallon tank. To prevent hydraulic movement of the adjacent plumes, the State of Alaska Plan Approval to Construct stipulated a pumping rate limitation of 60 gallons per minute. Additionally, contract restrictions required that initial filling of the storage tank be done with tank trucks rather than from the DRMO Yard aquifer. A granulated activated carbon treatment system was installed for the drinking water supply to remove taste, odor, and potential contaminants of concern.

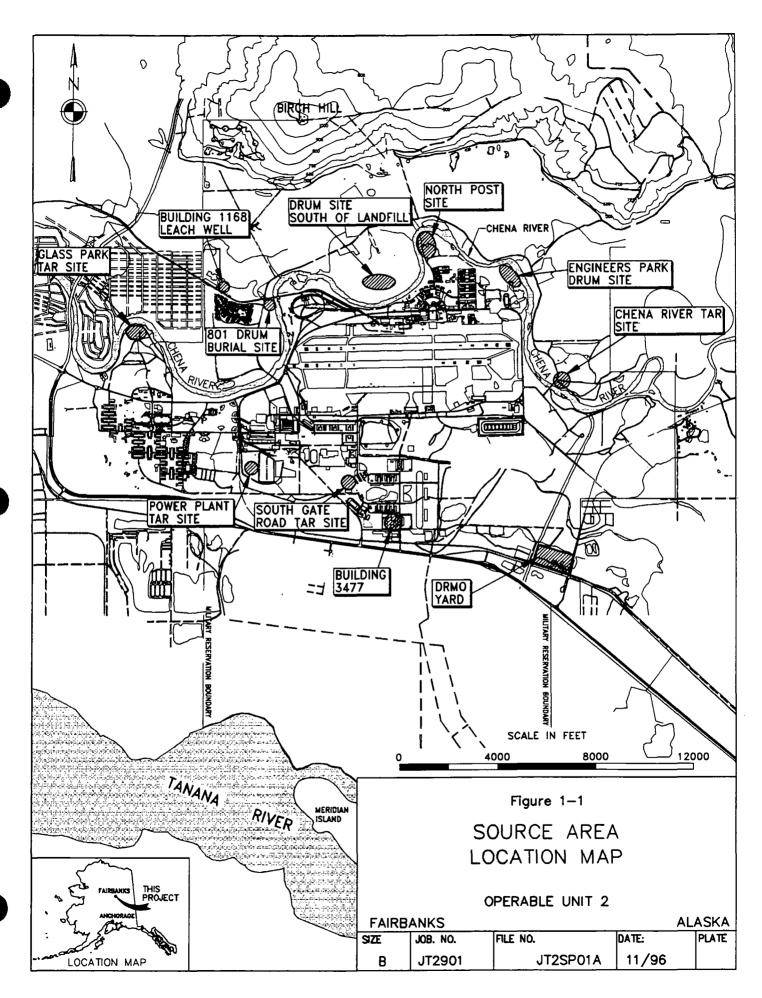
Residential developments that utilize private wells for domestic water supply are close to the DRMO Yard and Building 1168 Leach Well source areas. Some of these private wells near

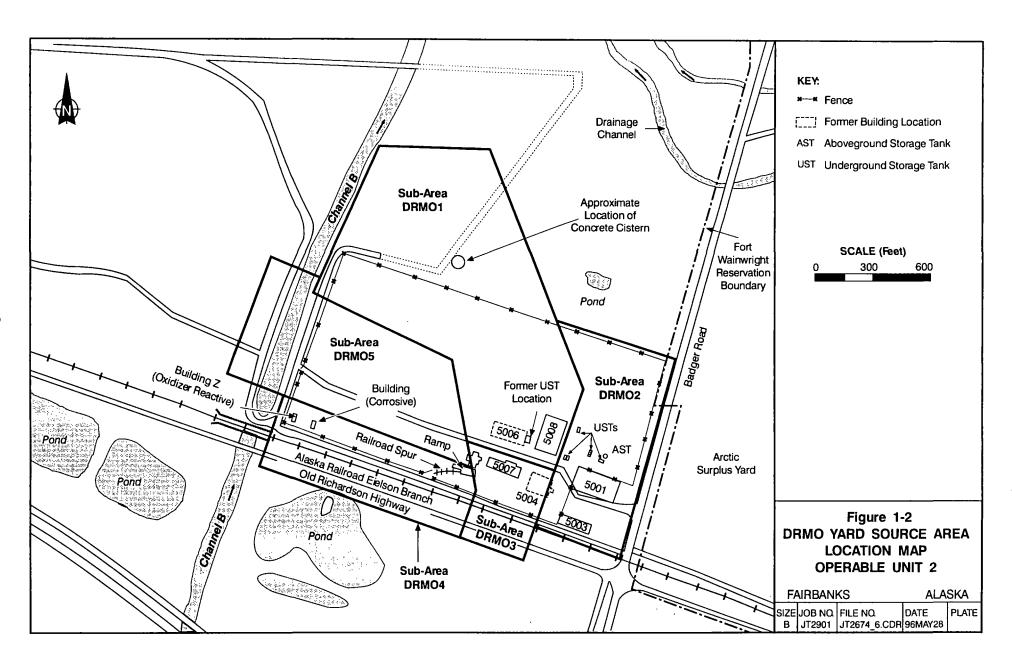
the DRMO Yard are contaminated with solvents and petroleum products. The DRMO Yard is not considered the source of these contaminants. Federal and state regulatory agencies are investigating several locations, not associated with Fort Wainwright, that were identified as potential sources of this contamination.

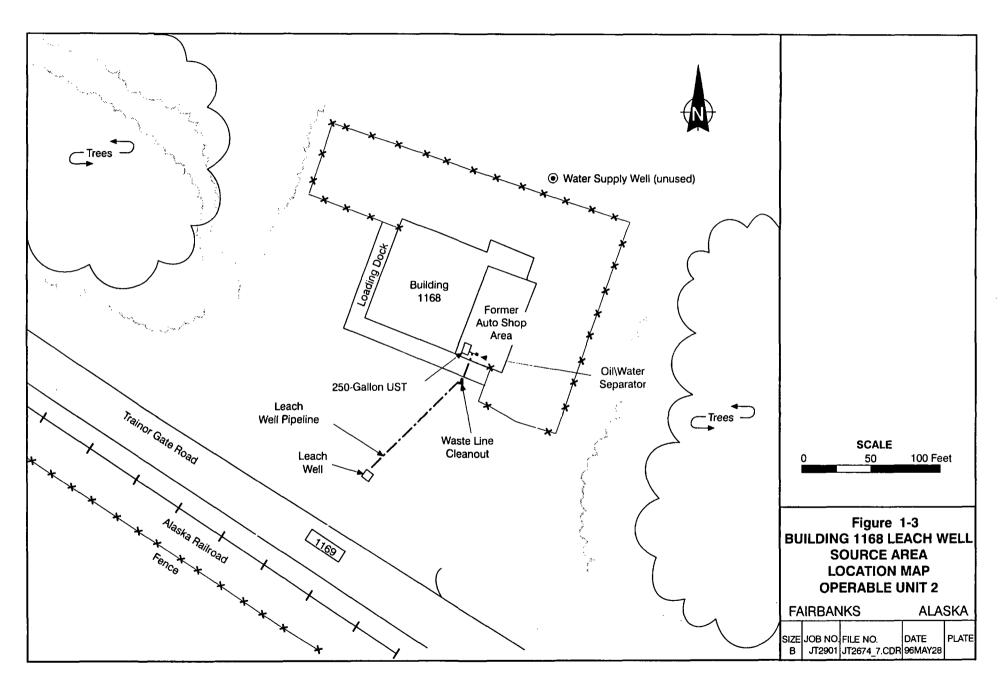
The City of Fairbanks uses the same aquifer and has four developed Municipal Utility System wells located 1 mile downgradient of the Post's boundaries, on the banks of the Chena River. These wells serve as the main drinking water supply for most of the City of Fairbanks.

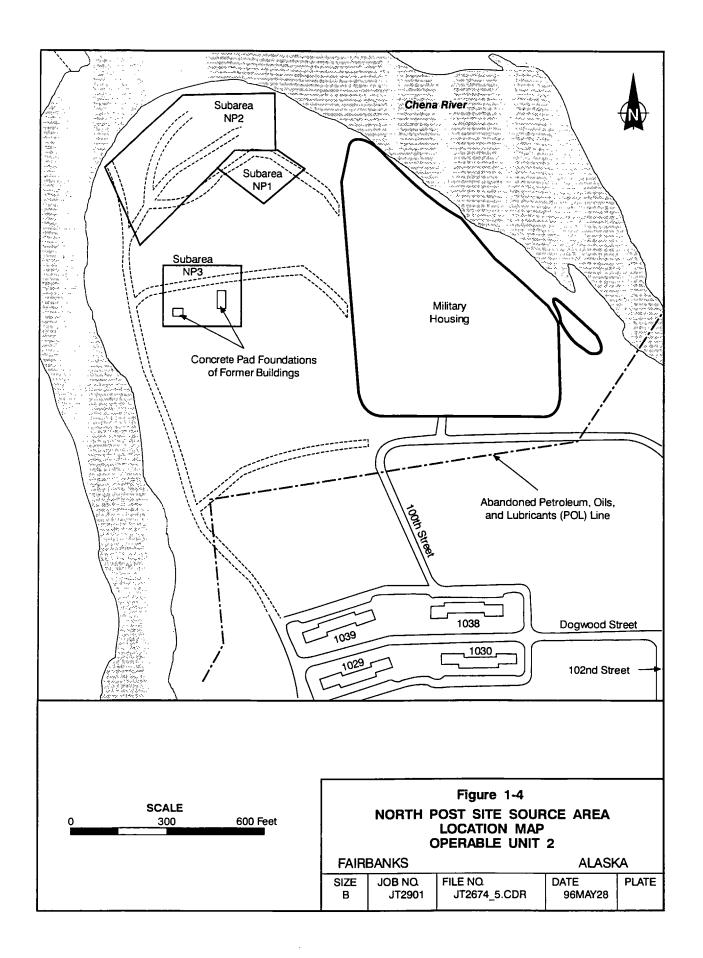
1.4 LAND USE

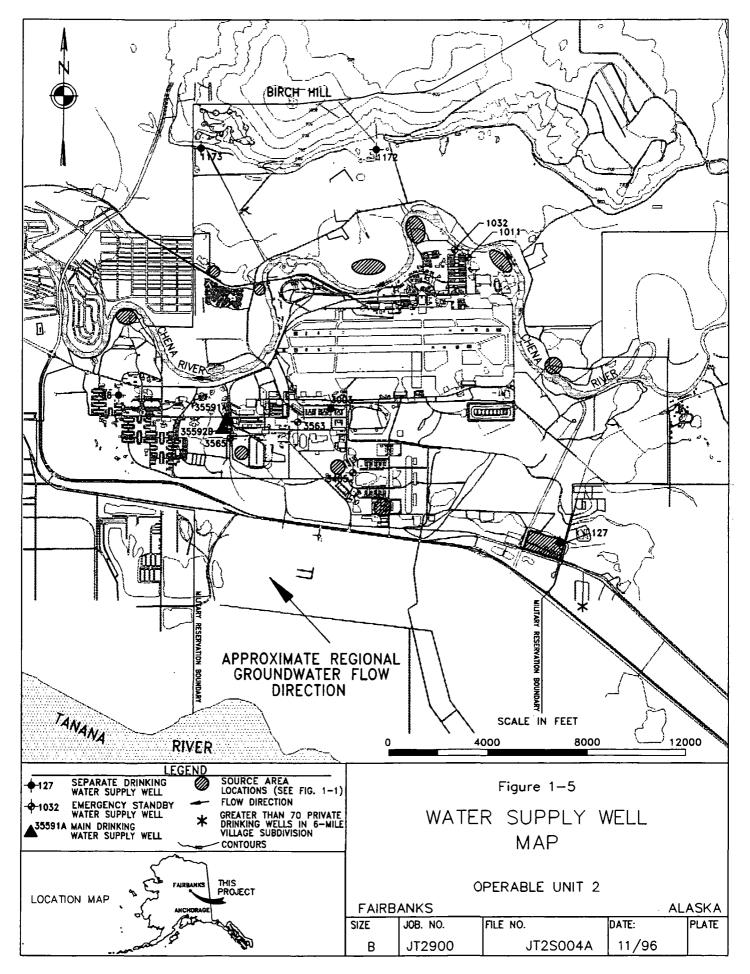
Current land use for the OU-2 source areas is light industrial. Although no residences are located on any source area, residential developments are close to the DRMO Yard and Building 1168 Leach Well source areas. Domestic water use occurs at one OU-2 source area: the DRMO Yard. Groundwater in the aquifer under these source areas is the sole source of drinking water for Fort Wainwright and the City of Fairbanks. Operations at the DRMO Yard and Building 1168 Leach Well are expected to continue indefinitely. Access is unrestricted to OU-2 source areas, except for the DRMO Yard.











2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE HISTORY

The DRMO Yard and Building 1168 Leach Well source areas have limited documents available to describe past practices. However, most source areas underwent evaluations, including sampling and analyses, before the RI. The source areas were listed as hazardous waste sites requiring further evaluation in the RCRA Facility Assessment.

2.1.1 Defense Reutilization and Marketing Office Yard

From 1945 to 1961, the DRMO Yard was used for vehicle storage and contained a vehicle maintenance shop. In 1961, the source area was converted into a salvage yard and was used to store drums of waste oil; pesticides; solvents; vehicle fluids such as antifreeze and hydraulic fluid; asphalt; and electrical transformers, some of which may have contained polychlorinated biphenyls (PCBs). Many drums reportedly leaked. Items such as mattresses, wood furniture, and possibly plastics were incinerated routinely in a burn pit. It is likely that the drummed fluids also were disposed of by burning. Waste oil, which historically contained heavy metals, solvents, PCBs, and other contaminants, was used to control dust on roads in the DRMO Yard during the 1970s and early 1980s. During the early 1980s, an estimated 3,000 gallons to 8,000 gallons of No. 1 diesel fuel were spilled near the former location of Building 5001. Cleanup included spreading the contaminated soil throughout the yard. Storage and destruction records were maintained by DRMO Yard personnel for three years and then were destroyed. Consequently, complete records of DRMO Yard activities are unavailable.

From 1988 to 1996, eight leaking underground petroleum storage tanks, ranging in size from 500 gallons to 10,000 gallons, were removed from the DRMO Yard. Cleanup of the associated petroleum-contaminated soil and groundwater is being conducted under the Two-Party Agreement.

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

The DRMO Yard serves as the permitted hazardous material transfer point for Fort Wainwright, Fort Greely, and Eielson Air Force Base.

2.1.2 Building 1168 Leach Well

Building 1168 was constructed as a lube oil and vehicle storage facility in 1949 and was converted into a petroleum test laboratory in 1962. The building contained a 10,000-gallon lube oil AST, oil/water separator system, 250-gallon UST that discharged to the leach well, 2,000-gallon heating oil UST, and septic system for sanitary waste. Contaminant and water mixtures apparently entered floor drains, passed through the oil/water separator, and flowed into the leach well that serviced the building. Contaminants suspected to have entered the floor drains include engine and transmission oil, gasoline, diesel, jet fuel, solvents, hydraulic fluid, and engine coolants.

As-built drawings from 1962 indicate that the room housing the 10,000-gallon AST was converted into a POL laboratory. The 10,000-gallon tank was removed, and a new floor and floor drain system were installed.

In 1985, the Post utility maintenance group replaced the waste line from Building 1168 to the leach well. The workers did not report any stained soil or odors; however, they reportedly felt light-headed when working near the connection to the leach well.

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI. From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the Building 1168 Leach Well.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and a RCRA Facility Assessment conducted by EPA recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases via the leach well and UST.

In 1994, a pilot-scale remediation system was installed around the leach well to determine whether an in situ treatment system was technically feasible in source area soils because the contamination is located mainly in subsurface soils and groundwater. Progress reports have shown that the soil vapor extraction (SVE)/air sparging (AS) system has been very effective as a remediation technology at this source area.

2.2 ENFORCEMENT ACTIVITIES

Fort Wainwright was placed on the CERCLA NPL in August 1990. Consequently, a Federal Facilities Agreement (FFA) was signed by EPA, the Alaska Department of Environmental Conservation (ADEC), and the United States Department of Army in spring 1992. The FFA ensures that appropriate actions are taken to protect public health and the environment in accordance with state and federal laws. The FFA divided Fort Wainwright into five OUs, one of which is OU-2, and outlines the general requirements for investigation and/or remediation of suspected historical hazardous waste source areas associated with Fort Wainwright.

An additional goal of the FFA was to integrate the Army's CERCLA response obligations and RCRA corrective action obligations. Remedial actions implemented will be protective of human health and the environment such that remediation of releases shall obviate the need for further corrective actions under RCRA (i.e., no further corrective action shall be required for source areas).

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The public was encouraged to participate in the selection of the remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The Fort Wainwright Proposed Plan for Remedial Action, Operable Unit 2 presents more than 11 combinations of options considered by the Army, EPA, and ADEC to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and was sent to 130

known interested parties, including elected officials and concerned citizens. An informational Fact Sheet dated March 1996, providing information about the Army's entire cleanup program at Fort Wainwright, was mailed to the same mailing list.

The Proposed Plan summarizes available information regarding OU-2. Additional materials were placed in two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public is welcome to inspect materials available in the Administrative Record and the information repositories during business hours. The Administrative Record index is provided in Appendix B.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center Prow Room in Fairbanks. No official comments were received from the public during the comment period. Six people attended the public meeting.

Display advertisements in the *Fairbanks Daily News-Miner*, published on April 28 and May 1, 5, 6, 7, and 8, 1996, also include information regarding the information repositories, the toll-free telephone line, and an address for submitting written comments.

The Responsiveness Summary in Appendix C summarizes and addresses public comments on the Proposed Plan and the remedy selection process.

2.4 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

As with many Superfund sites, the problems at Fort Wainwright are complex. OU-2 will be the third OU, following OU-3 and OU-4, at Fort Wainwright to have completed the RI/FS process and to begin remedial action activities. The OU-2 RI and FS were performed in accordance with the RI/FS Management Plan for OU-2. The RI fieldwork was conducted during summer 1993. The final RI, Data Validation Review, Risk Assessment, and FS reports were submitted to EPA and the State of Alaska in January, September, and October 1995 and April 1996, respectively.

This ROD presents the selected remedial action for OU-2 chosen in accordance with CERCLA as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The decision for OU-2 is based on the Administrative Record.

The remedial actions described in this ROD address threats to human health and the environment posed by the contamination at OU-2. The RI/FS has defined potential risks posed by existing groundwater contamination and the potential for migration if remediation does not occur.

3.0 SUMMARY OF SOURCE AREA CHARACTERISTICS

Physical features, hydrogeologic conditions, and the nature and extent of contamination for the DRMO Yard and Building 1168 Leach Well source areas are described briefly in the following sections.

3.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

3.1.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the DRMO Yard source area grades gently to the north and northwest. However, numerous depressions and the presence of silty soil may promote surface water ponding. Surface water runoff from the northeast portion of the source area drains east to a drainage ditch, adjacent to Badger Road, that eventually drains into the Chena River. Surface water runoff from the west half of the source area may enter Channel B, a man-made, riprapped conveyance that parallels the west boundary of the DRMO Yard and connects the Chena and Tanana Rivers. Flow is predominantly toward the Chena River, approximately 1 mile away.

A shallow stream bed located north of the DRMO Yard source area may serve as a channel for surface water runoff to the Chena River during spring breakup and heavy precipitation. A small pond is located 150 feet north of the DRMO Yard; however, the pond does not discharge into a well-defined surface drainage system and the relationship of the pond to groundwater is unknown.

At the DRMO Yard, surface soil can be characterized as fill material, 3 feet to 6 feet deep, consisting of silt, silty sands, and gravels. Subsurface soil at the DRMO Yard is variable and consists of layers of unconsolidated silty sand, gravel, silt, and alluvial deposits of sand and gravel.

Contaminants were detected in surface soil, subsurface soil, sediment, surface water, and groundwater at the DRMO Yard.

Contaminants in surface soil are available to migrate via surface runoff. Although the DRMO Yard is relatively flat, nearby ponds and drainage ditches may receive contaminated runoff from the site. Contaminated runoff from the DRMO Yard would be deposited in sediments. Dissolved contaminants in runoff may be transported through the system of drainage channels and streams in and around the source area to the Chena River. Contaminants in surface soil also can migrate via infiltration to subsurface soil through the downward percolation of precipitation and snowmelt. The extent of contaminant infiltration into subsurface soil depends on the affinity of specific contaminants to adsorb or complex with soil particles. Surface soil contamination also can migrate from the DRMO Yard via particulate transport and volatilization; however, this migration pathway is considered relatively minor because of the six-month snow cover in the Fairbanks area.

Contaminants in subsurface soil are available to migrate downward through percolation to groundwater, caused by infiltration of precipitation and snowmelt. Volatile subsurface soil contaminants also can migrate upward to the surface through volatilization.

Groundwater is encountered at approximately 7.5 feet BGS in an unconfined drinking water aquifer consisting of poorly graded, coarse-grained deposits of sand and gravel. Groundwater generally flows west to northwest toward Channel B, which was constructed as part of the Chena River flood control project that connects the Chena and Tanana Rivers. Changes in flow direction in Channel B occur frequently and are attributable to water level changes in the Chena and Tanana Rivers. This change may result in Channel B recharging groundwater near the DRMO Yard. However, fluctuations in flow direction occur frequently and are attributable to water level changes in the Chena and Tanana Rivers.

Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients. Contaminated groundwater migrating from the DRMO Yard area eventually may be discharged to Channel B or to the drainage channel located north of the DRMO Yard (see Figure 1-3).

Residents in three nearby subdivisions use groundwater as a drinking water source. These private wells are located upgradient of the DRMO Yard, in the same unconfined aquifer as the identified DRMO Yard groundwater contamination. Groundwater generally flows west to northwest, away from these residential areas; however, fluctuations in flow direction occur. The first residential area is approximately 1,400 feet to the north, the second is approximately 1,000 feet to the northeast, and the third is approximately 400 feet to the southeast. A public drinking water well and fire suppression system were installed in 1996 and are in service within the fenced DRMO Yard. This well was installed directly upgradient of the known groundwater solvent contamination plume, at a depth of 102 feet. The solvent plume extends from approximately 7 feet BGS to between 30 feet and 40 feet BGS. Pumping rates at the public drinking water well will be limited until federal Safe Drinking Water Act and State of Alaska Drinking Water Standard maximum contaminant levels (MCLs) are achieved in the contaminant plume to reduce the chance of changing plume characterization and of causing the plume to be drawn within the cone of influence of the potable water well.

3.1.2 Nature and Extent of Contamination

From 1990 through 1993, investigations including geophysical surveys, surface and subsurface soil sampling, and installation of groundwater monitoring wells were conducted to identify the extent of contamination at the DRMO Yard.

In July 1992, 12 borings and two monitoring wells were installed in an area north of Building 5001 at the DRMO Yard as part of a geotechnical investigation for placing a building foundation. Petroleum hydrocarbons that exceeded ADEC's soil cleanup levels were detected in the soils. Groundwater in one monitoring well contained trichloroethene (TCE) at 8.6 parts per billion (ppb). The state and federal MCL for TCE is 5 ppb. A petroleum UST was associated with the most significant contamination at this source area, which is being remediated under the Two-Party Agreement.

Additional areas of soil and groundwater contamination at the DRMO Yard were investigated through a Preliminary Source Evaluation at the DRMO Yard in September 1992. The evaluation confirmed results from previous investigations conducted in the vicinity of and in the DRMO Yard. Petroleum hydrocarbons and volatile organic compounds (VOCs) associated with fuels and low levels of dioxins/furans, PCBs, and pesticides were detected in

soils and groundwater.

In 1993, the OU-2 RI was conducted. The main objectives at the DRMO Yard were to verify information about the nature and extent of surface and subsurface soil and groundwater contamination and to collect information of sufficient quality to be used in a Baseline Risk Assessment. The field investigation consisted of the following tasks: a geophysical survey, surface and subsurface soil sampling, installation of groundwater probes and monitoring wells, collection of groundwater samples, surface water and sediment sampling, and aquifer testing.

Contaminants detected in soil, groundwater, and sediments included organic compounds; i.e., petroleum hydrocarbons, PCBs, polynuclear aromatic hydrocarbons, chlorinated VOCs, dioxins, and pesticides. Several inorganic elements also were detected; i.e., manganese, lead, and arsenic (see Tables 3-1 through 3-5). These contaminants are believed to have come from several on-site sources, including former petroleum USTs; on-site storage of electrical transformers and drums without secondary containment; and the incineration of mattresses, wood furniture, drummed fluids, and plastics in an on-site fire burn pit. These contaminants were compared to existing background levels determined for inorganics in this mineral-rich area, screened for inclusion in the Human Health and Ecological Risk Assessment, and compared to state and federal drinking water standards. Analytes were retained as contaminants of concern if they exceeded background levels, standard risked-based screening criteria for residential exposure assumptions of 1×10^{-7} for soils and 1×10^{-6} for groundwater and a hazard index of 0.1, or state and federal MCLs. The levels of inorganics are attributable to elevated background concentration. No floating products (lighter-than-water nonaqueous phase liquids [LNAPLs]) or pure product solvents (denser-than-water nonaqueous phase liquids [DNAPLs]) were identified in the groundwater at the DRMO Yard.

This source was divided into six sub-areas. Sub-areas were used because of the size of the site, and to accurately characterize different types of suspected contaminants based on historical activities or known releases that had occurred. Planned remediation of source areas also is identified by sub-area.

The suspected sources of contaminants in the soil and groundwater at two sub-areas, DRMO2 and DRMO3, are removed USTs. Contaminants include petroleum and fuel products that exceed State of Alaska soil cleanup levels. Groundwater contamination included TCE and tetrachloroethene (PCE) at levels below state and federal MCLs.

Petroleum hydrocarbons in soil and groundwater at sub-area DRMO5 exceeded State of Alaska soil cleanup levels for UST petroleum-contaminated soil. This source area also contained PCBs at concentrations below action levels and one soil boring with dieldrin at a concentration of 1.0 milligrams per liter. A resampling event was conducted at this source area; five samples were collected in the vicinity of the positive dieldrin sample. The results were nondetect or less than screening levels. Because of the type of contaminants and suspected sources of contamination in DRMO2, DRMO3, and DRMO5, these source areas are being remediated under the Two-Party Agreement.

At sub-area DRMO1, two contaminants—PCE and TCE—were detected in the groundwater at levels above their state and federal MCLs of 5 ppb. A well-defined groundwater plume, with

maximum concentrations of 190 ppb and 17 ppb for PCE and TCE, respectively, has been identified. PCE has migrated to the northwest in the direction of the groundwater flow and extends beyond the DRMO Yard boundary, toward Channel B. The extent of the PCE plume is illustrated in Figure 3-1. TCE detected in groundwater and soil is likely a degradation product of PCE. The RI indicates that PCE-saturated soils above the groundwater plume are the source of groundwater contamination; however, soil contaminant levels were not found at concentrations that would result in the identified groundwater contaminant levels. The maximum depth of PCE in groundwater is between 30 feet and 40 feet BGS, with the highest concentration near the soil-water interface (7 feet BGS). This indicates that there is not a pure product DNAPL source in the aquifer. Shallow and fluctuating groundwater conditions contribute to the ongoing release of contaminants to groundwater. This is supported by the highest soil concentration found in the saturated vadose zone, possibly associated with subsurface releases from an abandoned wood stave pipe. Additionally, the groundwater plume isocontours and concentrations are indicative of a discrete defined subsurface source. While soil sampling in an approximate 75-foot grid in this area did not identify the source, the conceptual model supports its presence. The soils will be treated during in situ remediation at this site.

Benzo(a)pyrene was detected in three "hot spots" at sub-areas DRMO1 and DRMO4 (see Figure 3-1). Approximately 1,900 cubic yards of soil has been impacted by this compound. The source of the benzo(a)pyrene has not been identified, but the compound may be a by-product of the burning and drum storage activities within the "hot spot" areas at the source area. The maximum depth of detection was 2 feet BGS, indicating that the contaminant does not migrate readily through the soil column and is not a threat to groundwater.

At sub-area DRMO4, benzene and PCE in the groundwater exceed state and federal MCLs of 5 ppb (at 7.5 ppb and 51 ppb, respectively) and appear to originate from miscellaneous releases associated with operations occurring along a railroad spur. Soils contaminated with solvent and petroleum compounds are considered the source of groundwater contamination. The groundwater contamination is found at the southwest portion of the railroad spur and is isolated and small in size. Although only one groundwater sample exceeded the state and federal MCLs for PCE and two samples exceeded the state and federal MCLs for benzene, a well-defined groundwater plume is present. The contamination begins at the southwest portion of the railroad spur and extends northwest to the road, from the west gate through the DRMO Yard (see Figure 3-2). Several other compounds were detected at concentrations below action screening levels in the soil and groundwater during the RI.

At sub-area DRMO6, sample detections included petroleum hydrocarbons and low levels of PCBs, dioxins, and inorganic elements; however, no contaminants attributable to activities associated with this sub-area exceeded screening levels. Sediment and surface water sample results will be evaluated further for potential contribution to cumulative ecological risk in the postwide Risk Assessment. No action is planned for this sub-area.

3.1.3 Defense Reutilization and Marketing Office Yard Summary

The petroleum-related contamination, including diesel-range organics (DRO) and gasoline-range organics (GRO) found in soil and groundwater throughout the source area, will be addressed through the Two-Party Agreement, except in areas where they are comingled with

other contaminants of concern. The PCE and TCE groundwater contaminant plumes underlie a sizable portion of sub-areas DRMO1 and DRMO4. Groundwater monitoring well contaminant levels in these source areas exceed state and federal MCLs for PCE and TCE at DRMO1 and for PCE and benzene at DRMO4. In addition, "hot spots" of benzo(a)pyrene were found in DRMO1 and DRMO4. A summary of analytical results for the DRMO Yard can be found in Tables 3-1 through 3-5.

3.2 BUILDING 1168 LEACH WELL

3.2.1 Physical Features, Hydrogeologic Conditions, and Transport Pathways

The topography at the Building 1168 Leach Well source area is relatively flat. No surface water drainage pathways are evident. During periods of high precipitation and spring snowmelt, surface water may flow overland to low-lying areas north and southeast of the site. The nearest surface water body, the Chena River, is approximately 1,800 feet to the east. The source area is surrounded by a spruce-hardwood forest to the west, north, and east.

Subsurface soil at the Building 1168 Leach Well source area consists of unconsolidated lenses of interlayered silt, silty sand, and poorly graded sand and gravel, underlain by sandy gravel. Fine-grained silt deposits appear as shallow lenses within silty sand and sand, and are overlain mostly by silty gravel. Silty, gravelly surface soil is predominantly fill material, likely laid down when the Building 1168 parking lot was constructed. Near surface sand and silt are underlain mainly by poorly graded, loose- to medium-density, saturated, sandy gravel that is highly permeable.

Contamination originated from a leach well that received liquids collected in floor drains within Building 1168. Floor drains were connected to a buried pipe that discharged to the leach well at approximately 13 feet BGS. Because of the release mechanism, significant surface soil contamination has not been identified at this source area. Floor drains within the building are suspected of receiving spilled oil and lubricants, fuels, solvents, and engine coolants. Contaminants in subsurface soil are available to migrate vertically toward groundwater with infiltration of precipitation and snowmelt. Lateral spreading of contaminants in subsurface soil has occurred from point sources of contamination because of capillary forces and partitioning exceeding gravitational forces on contaminant movement. Volatile contaminants in subsurface soil also can migrate upward through volatilization from groundwater to soil.

Infiltration and percolation through contaminated soil have been contributors to groundwater contamination. Leaching through contaminated soils caused by fluctuating groundwater levels and the affinity of petroleum products to float also have been major factors in continued groundwater contamination.

Groundwater is the main contaminant migration pathway at the Building 1168 Leach Well source area. Groundwater was encountered between 12 feet to 17 feet BGS and flows to the northwest toward the west boundary of Fort Wainwright and off-post residential areas. No confining layers have been encountered in the source area. Dissolved contaminants in groundwater will migrate through advective forces, influenced by horizontal and vertical groundwater flow gradients.

3.2.2 Nature and Extent of Contamination

Numerous investigations occurred at the Building 1168 Leach Well before the start of the RI.

In 1990, a groundwater survey conducted by the United States Army Environmental Hygiene Agency and an EPA RCRA Facility Assessment recommended further investigation at the Building 1168 Leach Well. This recommendation was based on the high potential for releases from the leach well and UST.

In 1992 and 1993, a Preliminary Source Evaluation was performed and included analytical measurements of surface and subsurface soil and groundwater samples. Petroleum hydrocarbons were detected in subsurface soil samples exceeding the State of Alaska cleanup levels for non-UST petroleum-contaminated soil. TCE and benzene exceeded the state and federal MCLs of 5 ppb. Ethylbenzene and xylenes also were detected in groundwater. The highest analyte concentrations in soil and groundwater were from samples closest to the leach well.

The OU-2 RI was conducted in 1993. The principal objectives of the RI at the Building 1168 Leach Well were to obtain information about the nature and extent of subsurface soil and groundwater contamination. The field investigation consisted of the following tasks: one surface soil sample, numerous subsurface soil samples, installation of two monitoring wells, collection of groundwater samples, aquifer testing, and a Treatability Study.

The RI results confirmed petroleum hydrocarbon and semivolatile organic compound contamination in groundwater, specifically benzene and TCE above state and federal MCLs of 5 ppb. No floating petroleum product (LNAPL) was found in the groundwater at this site. Manganese also exceeded risk-based concentrations but is attributable to background concentrations in this minerally rich area.

Contaminants detected in subsurface soils at the Building 1168 Leach Well include inorganics and petroleum hydrocarbons. Groundwater at the Building 1168 Leach Well contained petroleum hydrocarbons, aromatic and chlorinated VOCs, and inorganic elements. Tables 3-6, 3-7, and 3-8 list the chemicals detected in soil and groundwater at the Building 1168 Leach Well.

In subsurface soil, petroleum hydrocarbon-contaminated soil extends approximately 50 feet radially from the leach well. Contaminant concentrations decrease with increasing horizontal distance from the leach well. The thickness of subsurface soil contamination ranges from the bottom of the leach well to the seasonal low-water table elevation. A smear zone approximately 4 feet thick exists underneath the leach well and is a result of water table level fluctuations. An estimated 1,300 cubic yards of subsurface soil has been impacted by contaminants discharged from the leach well (see Figure 3-3). Table 3-6 lists the analytes detected in soil.

The contaminated soil around the leach well appears to be the source of petroleum hydrocarbons and VOCs detected in groundwater. Contamination from subsurface soil has created a comingled benzene and TCE plume in groundwater 20 feet to 50 feet BGS. The plume extends horizontally downgradient (northwest) approximately 400 feet from the leach

well (see Figure 3-4). Measurable free-floating product on the groundwater has not been detected at the Building 1168 Leach Well.

An SVE/AS pilot-scale treatability study was initiated in November 1994. Quarterly monitoring results indicate at least a 50% reduction of petroleum-related contaminants in groundwater in the active treatment zone over the last two years. Benzene and TCE were not detected within the active zone. However, exceedances of state and federal MCLs still exist outside the pilot-scale active treatment zone.

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

	(88)											
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs						
Petroleum Hydrocarbons												
Diesel-range organics ^b	328/163	0.0038 - 9,600	AP-6738	100	NA	37						
Gasoline-range organics ^c	322/66	0.25 - 690	AP-6773	50	NA	15						
Volatile Organic Compounds												
1,2,4-Trimethylbenzene	323/9	0.004 - 2.8	AP-6773	39	NA	0						
1,3,5-Trimethylbenzene	323/18	0.006 - 5.6	AP-6773	31	NA	0						
Acetone	323/30	0.017 - 0.42	AP-6806	7,800	NA	0						
Benzene	323/4	0.006 - 0.008	AP-6771	22	NA	0						
Cumene (isopropylbenzene)	323/2	0.0092 - 0.016	AP-6806	3,100	NA	0						
Ethylbenzene	323/5	0.003 - 0.023	AP-6771	7,800	NA	0						
m&p-Xylene	323/7	0.005 - 0.077	AP-6771	160,000	NA	0						
Methylene chloride	323/212	0.003 - 0.095	AP-6773	85	NA	5						
n-Butylbenzene	323/6	0.006 - 0.63	AP-6806	NA	NA	NA						
n-Propylbenzene	323/2	0.0082 - 0.023	AP-6806	NA	NA	NA						
o-Xylene	323/7	0.002 - 0.035	AP-6771	160,000	NA	0						
p-Isopropyltoluene	323/13	0.005 - 2.2	AP-6771	NA	NA	NA						

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs				
sec-Butylbenzene	323/2	0.011 - 0.220	AP-6806	780	NA	0				
tert-Butylbenzene	323/1	0.0034	AP-6796	780	NA	0				
Tetrachloroethene	323/24	0.0025 - 0.15	AP-6803	12	NA	0				
Toluene	323/11	0.0024 - 0.09	AP-6771	16,000	NA	0				
Semivolatile Organic Compounds										
2-Methylnaphthalene	328/8	0.057 - 13	AP-6773	NA	NA	NA				
Acenaphthene	328/2	0.130 - 0.170	AP-6763	4,700	NA	0				
Anthracene	328/4	0.050 - 0.350	AP-6796	23,000	NA	0				
Benzo(a)anthracene	328/7	0.045 - 0.320	AP-6758	0.88	NA	0				
Benzo(a)pyrene	328/7	0.049 - 0.350	AP-6758	0.088	NA	6				
Benzo(b)fluoranthene	328/9	0.048 - 0.350	AP-6758	0.88	NA	0				
Benzo(g,h,i)perylene	328/7	0.046 - 0.370	AP-6747	NA	NA	NA				
Benzo(k)fluoranthene	328/7	0.052 - 0.330	AP-6758	8.8	NA	0				
bis(2-ethylhexyl)-phthalate	328/28	0.029 - 1.600	AP-6745	46	NA	0				
Butyl benzyl phthalate	328/7	0.150 - 0.710	AP-6798	16,000	NA	0				
Chrysene	328/8	0.046 - 0.390	AP-6758	88	NA	0				

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs
di-n-Butyl phthalate	327/133	0.024 - 2.600	004	NA	NA	NA
Dibenzo(a,h)anthracene	328/2	0.052 - 0.084	AP-6758	0.088	NA	0
Fluoranthene	328/11	0.058 - 0.660	AP-6758	3,100	NA	0
Fluorene	328/4	0.230 - 1.0	AP-6738	3,100	NA	0
Indeno(1,2,3-cd)pyrene	328/5	0.052 - 0.2	AP-6758	0.88	NA	0
Naphthalene	651/10	0.004-4.7	AP-6738	3,100	NA	0
Phenanthrene	328/16	0.059 -0.950	AP-6773	NA	NA	NA
Pyrene	328/9	0.091 - 0.640	AP-6758	2,300	NA	0
Other Organic Compounds						
Total organic carbon	331/331	290 - 40,300	AP-6736	NA	NA	NA
PCBs and Organochlorine Pesticides	; · · · ·					
4,4'-Dichlorodiphenyldichloroethane (DDD)	331/31	0.0024 - 0.039	AP-6751	2.7	NA	0
4,4'-Dichlorodiphenyldichloroethene (DDE)	331/38	0.0016 - 0.059	AP-6739	1.9	NA	0
4,4'-Dichlorodiphenyltrichloroethane (DDT)	331/119	0.0013 - 1.1	AP-6747	1.9	NA	0

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs
Aroclor 1254	331/2	0.026 - 0.430	AP-6730	0.083	NA	2
Aldrin	331/1	0.00065	AP-6806	0.038	NA	0
Aroclor 1260	331/55	0.017 - 1.3	005	0.083	NA	25
beta-BHC	331/4	0.00057 - 0.0016	AP-6797	0.35	NA	0
Dieldrin	331/4	0.012 - 1.0	AP-6794	0.04	NA	2
Endosulfan I	331/1	0.016	AP-6796	470	NA	0
Endosulfan II	331/5	0.00078 - 0.016	AP-6758	470	NA	0
Endrin	331/3	0.0097 - 0.014	AP-6794	23	NA	0
Endrin aldehyde	331/1	0.0086	AP-6803	NA	NA	NA
Endrin ketone	331/5	0.0015 - 0.027	SP-6796	NA	NA	NA
gamma-BHC (Lindane)	331/6	0.0042 - 0.130	SP-6763	0.49	NA	0
Heptachlor epoxide	331/1	0.019	AP-6796	0.07	NA	0
Methoxychlor	331/1	0.0048	AP-6793	390	NA	0

SUMMARY OF SURFACE AND SUBSURFACE SOIL SAMPLE RESULTS DRMO YARD SOURCE AREA **OPERABLE UNIT 2** FORT WAINWRIGHT, ALASKA (mg/kg)

Analyte			Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs	
Metals							
Arsenic	332/318	0.79 - 72.4	AP-6744	0.37	29	318	
Barium	331/331	18 - 381	AP-6750	5,500	234	0	
Cadmium	331/84	0.48 - 8.1	AP-6782	39	NA	0	
Chromium	331/330	2.7 - 46.1	AP-6742	78,000	46	0	
Lead	336/332	1.7 - 996	AP-6735	400	NA	3	
Manganese	331/330	29.1 - 2,420	AP-6780	390	318	33	
Mercury	331/22	0.07 - 2.3	AP-6732	23	ND	0	
Selenium	331/214	0.051 - 4.1	AP-6750	390	0.17	0	
Silver	331/12	0.55 - 5.3	AP-6778	390	1.10	0	
Thallium	331/6	0.13 - 9.8	AP-6776	NA	ND	NA	
Dioxins/Furans (pg/g)							
2,3,7,8-TCDD TEQ	267/244	0.0008-97.356	AP-6734	4.1	NA	9	

Note: The RBC used for m&p-xylene is the RBC for xylenes mixed. No RBC for p-xylene in soil exists. The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is the one for the carcinogenic form of arsenic.

Table 3-1 (Cont.)

- a Risk-based screening concentration values are based on a 1 x 10⁻⁶ residential direct contact risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).
- b ADEC soil cleanup matrix score Level A for DRO is 100 mg/kg.
- C ADEC soil cleanup matrix score Level A for GRO is 50 mg/kg.

Key:

ADEC = Alaska Department of Environmental Conservation.

BHC = Benzenehexachloride.

DRMO = Defense Reutilization and Marketing Office.

DRO = Diesel-range organics.

GRO = Gasoline-range organics.

 μ g/kg = Micrograms per kilogram.

mg/kg = Milligrams per kilogram.

NA = Not applicable.

ND = Not detected.

PCBs = Polychlorinated biphenyls.

pg/g = Picograms per gram.

RBCs = Risk-based concentrations.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

SUMMARY OF SEDIMENT SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs
Petroleum Hydrocarbons					. 	
Diesel-range organics ^b	9/9	63 - 1,000	007	100	NA	5
Volatile Organic Compounds						
Chloroform	9/1	0.008	008	100	NA	0
Other Organic Compounds (%)					·	
Total organic carbon	רוד	1 - 9.35	007	NA	NA	NA
PCBs and Organochlorine Pesticid	es					
Aroclor 1260	9/3	7 - 60	007	0.083	NA	3
Metals						
Arsenic	9/9	8 - 38	001	0.37	NA	9
Barium	9/9	139 - 387	01	5,500	NA	0
Cadmium	9/4	2 - 6	007	39	NA	0
Chromium	9/9	18 - 49	007	78,000	· NA	0
Lead	9/9	10 - 1,390	007	400	NA	2
Manganese	9/9	251 - 5,140	002	390	NA	7

SUMMARY OF SEDIMENT SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	creening Background					
Dioxins/Furans (pg/g)										
2,3,7,8-TCDD TEQ	9/9	0.0043 - 71.98	007	4.10	NA	3				

Note: The RBC used for chromium is the one for trivalent chromium. The RBC used for arsenic is for the carcinogenic form of arsenic.

Risk-based screening concentration risk values are based on a 1 × 10⁻⁶ residential direct contact or an HQ = 1 (EPA, Region III, July 11, 1994, Risk-Based Concentration Tables).

b ADEC soil cleanup matrix score for Level A cleanup of DRO is 100 mg/kg.

Key:

ADEC = Alaska Department of Environmental Conservation.

DRO = Diesel-range organics.

DRMO = Defense Reutilization and Marketing Office.

μg/kg = Micrograms per kilogram. mg/kg = Milligrams per kilogram.

NA = Not applicable.

PCBs = Polychlorinated biphenyls.

pg/g = Picograms per gram.

RBCs = Risk-based concentrations.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCL
Petroleum Hydrocarbons							
Diesel-range organics	23/16	130 - 23,000	AP-5825	NA/NA	NA	NA	NA
Gasoline-range organics	31/8	50 - 940	AP-5825	NA/NA	NA	NA	NA
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	31/5	2.9 - 460	AP-5825	100/70	3	NA	1
1,3,5-Trimethylbenzene	31/5	3.7 - 130	AP-5825	100/NA	2.4	NA	NA
Chloroform	31/1	1.9	AP-6802	1,240/100	0.15	NA	0
cis-1,2-Dichloroethene	31/1	7.3	AP-5764	11,600/70	61	NA	0
Cumene	31/5	1.6 - 14	AP-5825	NA/NA	1,500	NA	NA
Ethylbenzene	31/3	2.6 - 3.7	AP-5825	0.2/700	1,300	NA	0
m&p-Xylene	31/3	3.2 - 92	AP-5825	0.2/10,000	520	NA	0
Methyl ethyl ketone	31/2	6.4 - 12	AP-5825	NA/NA	22,000	NA	NA
Methylene chloride	31/12	1 - 1.9	AP-6799	NA/5	4.1	NA	0
n-Butylbenzene	31/1	3.3	AP-6806	NA/NA	NA	NA	NA
n-Propylbenzene	3/31	1.7 - 16	AP-5825	NA/NA	NA	NA	NA

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCL
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
o-Xylene	31/1	170	AP-5825	0.2/10,000	1,400	NA	0
p-Isopropyltoluene	31/2	3.5 - 19	AP-5825	NA/NA	NA	NA	NA
sec-Butylbenzene	31/7	1.6 - 11	AP-5825	NA/NA	61	NA	NA
Tetrachloroethene (PCE)	31/6	1.3 - 190	AP-6803	840/5	1.1	NA	3
trans-1,2-Dichloroethene	3/31	1.2 - 1.7	AP-6804	11,600/100	120	NA	0
Trichloroethene (TCE)	5/31	4.8 - 17	AP-6804	5/5	1.6	NA	3
Trichlorofluoromethane	31/1	6.3	AP-5764	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds	5						
2-Methylnaphthalene	23/5	11 - 200	AP-5825	0.1/NA	NA	NA	NA
Benzoic acid	23/1	19	AP-6803	NA/NA	150,000	NA	NA
Fluorene	23/1	2	AP-6803	0.1/NA	1,500	NA	NA
Naphthalene	54/6	14 - 530	AP-5825	0.1/NA	1,500	NA	NA
Organophosphorus Pesticides							
Disulfoton	23/3	0.14 - 1.3	AP-5826	NA/NA	1.5	NA	NA

SUMMARY OF GROUNDWATER MONITORING WELL SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

				<u> </u>			
Analyte	Number of Samples Analyzed/ Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria (18 AAC 70/MCL 18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCL
Metals							
Arsenic (dissolved)	23/13	6 - 24	AP-5825	48/50	0.038	56	0
Arsenic (total)	23/13	6 - 23	AP-5825	48/50	0.038	230	0
Barium (dissolved)	23/20	100 - 310	AP-5825	1,000/2,000	2,600	520	0
Barium (total)	23/20	100 - 320	AP-5825	1,000/2,000	2,600	2,000	0
Lead (dissolved)	23/1	6	AP-6802	NA/15	NA	27	0
Manganese (dissolved)	23/20	250 - 13,000	AP-5825	50 ^b	180	1,900	20
Manganese (total)	23/20	270 - 13,000	AP-5825	50 ^b	180	1,900	20
Dioxins/Furans (pg/L)							
2,3,7,8-TCDD TEQ	20/19	0.33 - 8.4183	AP-5765	10/30	0.43	NA	0

Note: The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is for the carcinogenic form of arsenic.

Table 3-3 (Cont.)

a Risk-based screening concentration values are based on a 1 × 10⁻⁶ residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).

b Secondary MCL.

Key:

AAC = Alaska Administrative Code.

DRMO = Defense Reutilization and Marketing Office.

MCL = Maximum contaminant level.

 $\mu g/L = Micrograms per liter.$ NA = Not applicable.

pg/L = Picograms per liter.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

(μg/L)												
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs					
Petroleum Hydrocarbons			222222									
Diesel-range organics	94/65	120 - 41,000	P34	NA/NA	NA.	NA	NA					
Gasoline-range organics	89/19	70 - 28,000	P34	NA/NA	NA	NA	NA					
Volatile Organic Compounds												
1,2,4-Trimethylbenzene	93/11	1.3 - 340	P35	100/NA	3	NA	NA					
1,2-Dichlorobenzene	161/2	19 - 38	P15	763/600	370	NA	0					
1,2-Dichloroethane	93/1	1.5	P13	5/5	0.12	NA	0					
1,3,5-Trimethylbenzene	93/10	1.3 - 130	P35	100/NA	2.4	NA	NA					
1,3-Dichlorobenzene	161/1	1.5	P60	763/NA	540	NA	NA					
1,4-Dichlorobenzene	161/2	6 - 12	P15	763/75	0.44	NA	0					
Acetone	93/7	3.1 - 79	P35	NA/NA	3,700	NA	NA					
Benzene	93/6	1.4 - 7.5	P05	0.2/5.0	0.36	NA	3					
Chlorobenzene	93/1	2.6	P15	NA/100	39	NA	0					
Chloroform	93/27	1.1 - 8	MW2	1,240/100	0.15	NA	0					
cis-1,2-Dichloroethene	93/3	1.2 - 2.3	P59	116,000/70	61	NA	0					
Cumene	93/10	1.4 - 14	P34	NA/NA	1,500	NA	NA					

Key at end of table.

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SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Dichlorodifluoromethane	93/2	1.7 - 18	P07	11,000/NA	390	NA	NA
Ethylbenzene	93/7	1.3 - 6	P27	0.2/700	1,300	NA	0
m&p-Xylene	93/8	1.6 - 87	P35	0.2/10,000	520	NA	0
Methyl ethyl ketone (MEK)	93/21	2 - 110	Trip Blank	NA/NA	22,000	NA	NA
Methylene chloride	93/26	1 - 8.8	P35	NA/5	4.1	NA	2
n-Butylbenzene	93/1	30	P34	NA/NA	NA	NA	NA
n-Propylbenzene	93/8	1.6 - 32	P34	NA/NA	NA	NA	NA
x-Xylene	93/7	1.2 - 150	P35	0.2/10,000	NA	NA	0
p-Isopropyltoluene	93/10	1.5 - 200	P34	NA/NA	NA	NA	NA
sec-Butylbenzene	93/7	1.2 - 25	P34	NA/NA	61	NA	NA
Styrene	93/2	1.7 - 69	P57	NA/100	1,600	NA	0
Tetrachloroethene (PCE)	93/20	1.1 - 65	P35	840/5	1.1	NA	3
Toluene	93/5	1.5 - 3.7	P61	0.2/1,000	750	NA	0
trans-1,2-Dichloroethene	93/6	1.3 - 4.4	P43	11,600/100	120	NA	0
Trichloroethene (TCE)	93/19	1.4 - 9.1	P51	5/5	1.6	NA	12
Trichlorofluoromethane	93/2	1.6 - 4.1	P12	NA/NA	1,300	NA	0

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Semivolatile Organic Compounds							
2-Methylnaphthalene	68/9	1 - 240	P35	0.1/NA	NA	NA	NA
Dibenzofuran	68/1	2	P34	NA/NA	150	NA	NA
Diethylphthalate	68/1	10	P34	NA/NA	29,000	NA	NA
Fluorene	68/2	4 - 6	P34	0.1/NA	1,500	NA	NA
Naphthalene	161/20	1.6 - 410	P35	0.1/620	1,500	NA	0
Phenanthrene	68/1	4	P34	0.1/NA	NA	NA	NA
Organophosphorus Pesticides		-					
Diazinon	68/1	0.27	P37	NA/NA	33	NA	NA
Disulfoton	68/2	0.11 - 0.53	P46	NA/NA	1.5	NA	NA
Naled	68/2	0.18 - 0.87	P60	NA/NA	73	NA	NA
Ronnel	68/1	1,100	P27	NA/NA	1,800	NA	NA
Metals							
Arsenic (dissolved)	67/34	5 - 39	P39	48/50	0.038	56	0
Arsenic (total)	68/35	6 - 43	P39	48/50	0.038	230	0
Barium (dissolved)	67/64	30 - 420	P07	1,000/2,000	2,600	520	0

SUMMARY OF GROUNDWATER PROBE SAMPLE RESULTS DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Barium (total)	68/65	30 - 1,200	P04	1,000/2,000	2,600	2,000	0
Chromium (total)	64/8	20 - 510	P57	11/100	37,000	390	2
Lead (dissolved)	67/3	3 - 5	P23	NA/15	0.0037	27	0
Lead (total)	68/10	2 - 14	P21	NA/15	0.0037	160	0
Manganese (dissolved)	67/63	20 - 6,100	P35	NA/50 ^b	180	1,900	57
Manganese (total)	68/65	20 - 6,400	P35	NA/50 ^b	180	1,900	57
Mercury (dissolved)	67/1	0.8	P Slough 1	0.012/2	11	NA	0
Dioxins (pg/L)							
2,3,7,8-TCDD TEQ	68/50	0.02 - 8.66	P25	10/30	0.43	NA	0

Note: The RBC used m&p-xylene as the one for p-xylene. This RBC is the more conservative of the two RBCs. The RBC used for arsenic is for the carcinogenic form of arsenic.

a Risk-based screening concentration values are based on a 1 × 10⁻⁶ residential direct contact risk or HQ = 1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).

b Secondary MCL.

Table 3-4 (Cont.)

Key:

AAC = Alaska Administrative Code.

DRMO = Defense Reutilization and Marketing Office.

MCL = Maximum contaminant level.

 $\mu g/L$ = Micrograms per liter.

NA = Not applicable.

pg/L = Picograms per liter.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQ = Toxicity equivalency.

SUMMARY OF SURFACE WATER SAMPLE RESULTS COLLECTED FROM CHANNEL B DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons						-	
Diesel-range organics	4/1	62	003	NA/NA	NA	NA	NA
Volatile Organic Compounds			·				
Chloroform	4/3	0.5 - 3.2	002	1,240/100	0.15	NA	0
Methylene chloride	4/3	1 - 1	002	NA/NA	4.1	NA	NA
Metals	_						
Barium (dissolved)	4/4	71 - 74	001	1,000/2,000	2,600	520	0
Barium (total)	4/4	70 - 74	003	1,000/2,000	2,600	2,000	0
Manganese (dissolved)	4/4	479 - 536	. 001	NA/50 ^b	180	1,900	4
Manganese (total)	4/4	478 - 532	001	NA/50 ^b	180	1,900	4

a Risk-based screening concentration values are based on a 1 × 10⁻⁶ residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).

b Secondary MCL.

Table 3-5 (Cont.)

Key:

AAC = Alaska Administrative Code.

DRMO = Defense Reutilization and Marketing Office.

MCL = Maximum contaminant level.

 μ g/L = Micrograms per liter. NA = Not applicable.

SUMMARY OF SOIL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

	·					
Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs
PCBs and Organochlorine Pesticides						
4,4'-Dichlorodiphenyltrichloroethane	5/1	0.0048	AP-6808	1.9	NA	1
Metals						
Arsenic	5/5	1.3 - 5.1	AP-6808	0.37	17	5
Barium	5/5	29 - 120	AP-6808	5,500	275	0
Cadmium	5/5	0.73 - 2.2	AP-6808	39	1.7	0
Chromium	5/5	6.8 - 22	AP-6808	78,000	35	0
Lead	5/5	2.4 - 7.9	AP-6808	400	25	0
Manganese	5/5	93 - 380	AP-6808	390	NA	0
Selenium	5/1	0.22	AP-6808	390	NA	0
Silver	5/4	0.98 - 3.7	AP-6808	390	NA	0
Petroleum Hydrocarbons			·			·
DRO	7/7	260 - 7,700	SB-2	100 ^b	NA	7
GRO	. 7/7	26 - 4,600	SB-1	50°	NA	6
Volatile Organic Compounds			,	·		
Benzene	7/0	NA	NA_	22	NA	NA
m&p-Xylenes	7/6	4.4 - 62	SB-3	160,000	NA	0

SUMMARY OF SOIL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Analyte	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding RBCs
o-Xylenes	7/6	2.9 - 31	SB-3	160,000	NA	0
Toluene	7/4	0.34 - 10	SB-3	16,000	NA	0
втех	7/6	7.3 - 103	SB-3	10 ^d	NA	5
Trichloroethene	7/0	NA NA	NA	58	NA	0

Note: The RBC used for m&p-xylenes is the RBC for xylenes mixed. No RBC existes for p-xylenes in soil. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium.

- Risk-based screening concentration values are based on a 1 × 10⁻⁶ residential direct contact risk or an HQ=1 (EPA Region III, July 11, 1994, Risk Based Concentration Tables).
- b ADEC soil cleanup matrix score for Level A DRO is 100 mg/kg.
- C ADEC soil cleanup matrix score for Level A GRO is 50 mg/kg.
- d ADEC soil cleanup matrix score for Level A BTEX is 10 mg/kg.

Key:

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

DRO = Diesel-range organics.

GRO = Gasoline-range organics.

mg/kg = Milligrams per kilogram.

NA = Not applicable.

PCBs = Polychlorinated biphenyls.

RBCs = Risk-based concentrations.

SUMMARY OF GROUNDWATER SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Petroleum Hydrocarbons							
Diesel-range organics	15/9	77 - 34,000	AP-5751	NA/NA	NA	NA	NA
Gasoline-range organics	20/7	11 - 18,000	AP-5747	NA/NA	NA	NA	NA
Volatile Organic Compounds							
1,2,4-Trimethylbenzene	20/4	49 - 350	AP-5751	100/NA	3	NA	NA
1,3,5-Trimethylbenzene	20/4	18 - 150	AP-5751	100/NA	2.4	NA	NA
Acetone	20/1	41	AP-5751	NA/NA	3,700	NA	NA
Benzene	20/1	5.1	AP-5752	0.2/5	0.36	NA	1
Cumene	20/4	18 - 59	AP-5751	NA/NA	1,500	NA	NA
Ethylbenzene	20/4	26 - 310	AP-5751	0.2/700	1,300	NA	0
m&p-Xylene	20/4	44 - 620	AP-5751	0.2/10,000	520	NA	0
n-Butylbenzene	20/3	13 - 16	AP-5747	NA/NA	NA	NA	NA
n-Propylbenzene	20/4	21 - 71	AP-5751	NA/NA	NA	NA	NA
Naphthalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
o-Xylene	20/4	3 - 1,000	AP-5751	0.2/10,000	1,400	NA	0

SUMMARY OF GROUNDWATER SAMPLE RESULTS **BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2** FORT WAINWRIGHT, ALASKA (ug/L)

			(μg/L)				- <u></u>
Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
p-Isopropyltoluene	20/4	10 - 30	AP-5751	NA/NA	NA	NA	NA
sec-Butylbenzene	20/4	4.4 - 11	AP-5751	NA/NA	61	NA	NA
Toluene	20/1	770	AP-5751	0.2/1,000	750	NA	0
Trichloroethene	20/1	23	AP-5751	5/5	1.6	NA	1
Trichlorofluoromethane	20/3	5.1 - 26	AP-5781	NA/NA	1,300	NA	NA
Semivolatile Organic Compounds							
2-Methylnaphthalene	15/4	5 - 59	AP-5751	0.1/NA	NA	NA	NA
Naphthalene	35/8	5 - 130	AP-5751	0.1/NA	1,500	NA	NA
Metals							
Arsenic (dissolved)	15/7	1/2 - 27	AP-5751	48/50	0.038	20	0
Arsenic (total)	16/6	1.8 - 25	AP-5751	48/50	0.038	72	0
Barium (dissolved)	15/14	62 - 350	AP-5751	1,000/2,000	2,600	988	0
Barium (total)	16/14	48 - 330	AP-5751	1,000/2,000	2,600	341	0
Cadmium (dissolved)	15/1	4.9	AP-6333	9.3/5	18	4.8	0
Chromium (total)	16/2	8 - 48	AP-6332	11/100	37,000	NA	0

SUMMARY OF GROUNDWATER SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analyte and Concentration Units	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Lead (dissolved)	15/2	1.6 - 5.4	AP-5751	NA/15	0.0037	9.9	0
Lead (total)	16/14	1.1 - 21	AP-5751	NA/15	0.0037	66	1
Manganese (dissolved)	15/13	82 - 4,400	AP-5751	NA/50 ^b	180	NA	11
Manganese (total)	16/14	11 - 4,400	AP-5751	NA/50 ^b	180	NA	11
Selenium (dissolved)	15/2	2.4 - 3.1	AP-5751	10/50	180	NA	0
Selenium (total)	16/3	1.7 - 2.5	AP-5751	10/50	180	NA	0
Silver (total)	16/1	22	AP-5781	NA/100 ^b	180	NA	0

Note: The RBC used for m&p-xylene is the one for p-xylene. This RBC is the more conservative of the two. The RBC used for arsenic is the one for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium.

b Secondary MCL.

Key:

AAC = Alaska Administrative Code.

MCLs = Maximum contaminant levels.

 μ g/L = Micrograms per liter.

NA = Not applicable.

^a Risk-based screening concentration values based on a 1 x 10⁻⁶ residential risk or an HQ=1 (EPA, Region III, July 11, 1994, Risk Based Concentration Tables).

SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Metals							
Aluminum	27/27	135 - 39,300	PS10	NA/200	37,000	NA	24
Arsenic	27/15	6 - 44	PS12	48/50	0.038	76	0
Barium	27/27	104 - 1,030	PS10	1,000/2,000	2,600	988	0
Chromium	27/16	6 - 90	PS26	11/100	37,000	125	0
Copper	27/17	12 - 222	PS26	12/1,000	1,400	NA	0
Iron	27/27	1,340 - 188,000	PS26	1,000/300	NA	NA	27
Lead	27/17	2 - 49	PS10	3.2/15	0.0037	66	10
Manganese	27/27	25 - 2,930	PS21	NA/50 ^b	180	NA	26
Vanadium	27/14	10 - 116	PS10	NA/NA	260	NA	NA
Zinc	27/19	16 - 242	PS10	47/5,000	11,000	NA	0
Petroleum Hydrocarbons				33337			
GRO	27/10	57 - 63,100	PS01	NA/NA	NA	NA.	NA
DRO	27/27	55 - 28,400	PS01	NA/NA	NA	NA	NA

SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Alaska Water Number of Number of Range of Location of Quality Criteria Risk-Based Samples Samples Detected 18 AAC 70/MCL Maximum Screening Background Exceeding Analyzed/Detected Concentrations Concentration^a Analytes (18 AAC 80) **MCLs** Concentration Concentration **Volatile Organic Compounds** 1,2,4-Trimethylbenzene 27/6 2 - 800 **PS01** 100/NA 3 NA NA 27/5 3 - 370 NA 1,3,5-Trimethylbenzene PS01 100/NA 2.4 NA 1.3-Dichlorobenzene 27/1 3 763/NA 540 **PS21** NA NA 27/2 22,000 2-Butanone (MEK) 2 - 3 PS10 NA/NA NA NA 5 4-Chlorotoluene 27/1 NA/NA NA NA NA PS21 2 - 9 3,700 Acetone 27/9 **PS09** NA/NA NA NA 27/12 0.6 - 250PS01 0.2/5.0 0.36 NA Benzene 27/1 PS21 NA/NA NA NA NA Bromobenzene 21 NA Carbon disulfide 27/2 0.5 - 1**PS05** NA/NA NA 0.15 NA Chloroform 27/1 2.4 PS11 1,240/100 Dichlorodifluoromethane 27/7 0.7 - 1PS15 NA/NA 390 NA NA 3.6 - 650 PS01 0.2/700 1,300 NA 0 27/8 Ethylbenzene 1,500 NA NA 27/5 2 - 10 PS01 Cumene (Isopropylbenzene) NA/NA

SUMMARY OF MICROWELL SAMPLE RESULTS BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA (µg/L)

Analytes	Number of Samples Analyzed/Detected	Range of Detected Concentrations	Location of Maximum Concentration	Alaska Water Quality Criteria 18 AAC 70/MCL (18 AAC 80)	Risk-Based Screening Concentration ^a	Background Concentration	Number of Samples Exceeding MCLs
Naphthalene	27/3	6 - 250	PS01	0.1/NA	1,500	NA	NA
Toluene	27/8	0.6 - 2,700	PS01	0.2/1,000	750	NA	2
Total xylenes	27/10	1.4 - 4,300	PS01	NA/10,000	12,000	NA	0
Trichloroethene	27/6	1.0 - 47	PS23	5/5	1.6	NA	4
Trichlorofluoromethane	27/7	0.5 - 17	PS11	NA/NA	1,300	NA	NA
cis-1,2-Dichloroethene	27/4	0.7 - 9.5	PS21	11,600/70	61	NA	0
n-Propylbenzene	27/2	4 - 6	PS21	NA/NA	NA	NA	NA
Semivolatile Organic Comp	ounds						
2-Methylnaphthalene	27/3	19 - 29	PS23	0.1/NA	NA	NA	NA
3- and 4-Methylphenol	27/3	18 - 64	PS01	NA/NA	180	NA	NA
Naphthalene	27/4	10 - 87	PS23	0.1/NA	1,500	NA	NA

Table 3-8 (Cont.)

Note: The RBC used for arsenic is for the carcinogenic form of arsenic. The RBC used for chromium is the one for trivalent chromium. The RBC used for xylenes is the one for xylenes mixed. The RBC used for 3- and 4-methylphenol is the one for 4-methylphenol, the more conservative of the two.

Risk-based screening concentration values based on a 1 x 10⁻⁶ residential risk or HQ=1 (EPA, Region III, July 11, 1994, Risk-Based Concentration Tables).

b Secondary MCL.

Key:

AAC = Alaska Administrative Code.

DRO = Diesel-range organics.

GRO = Gasoline-range organics.

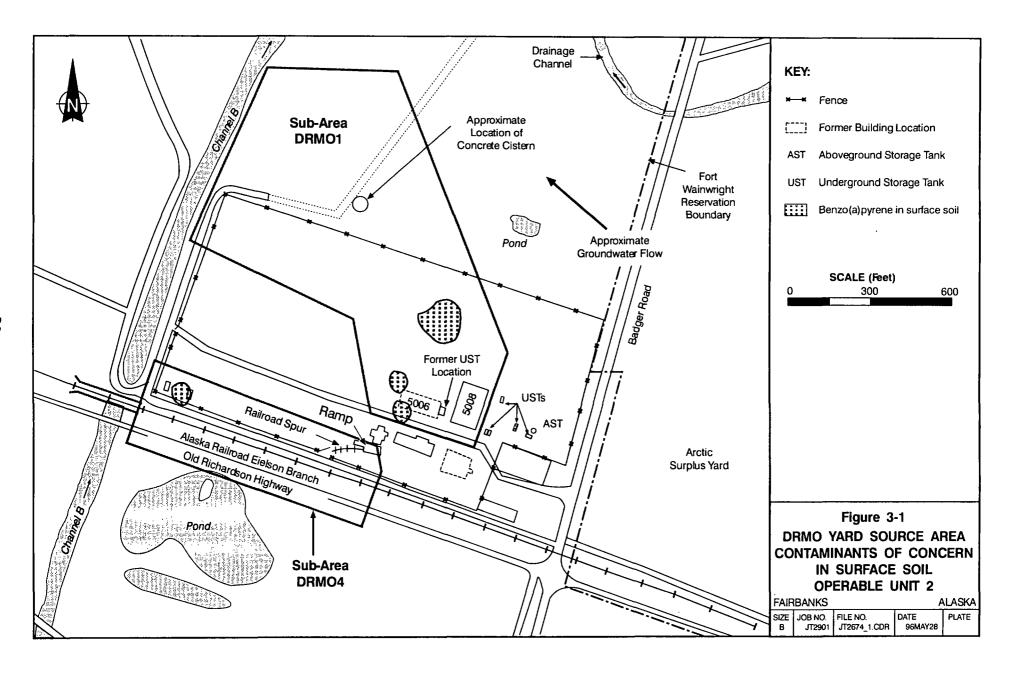
MCLs = Maximum contaminant levels.

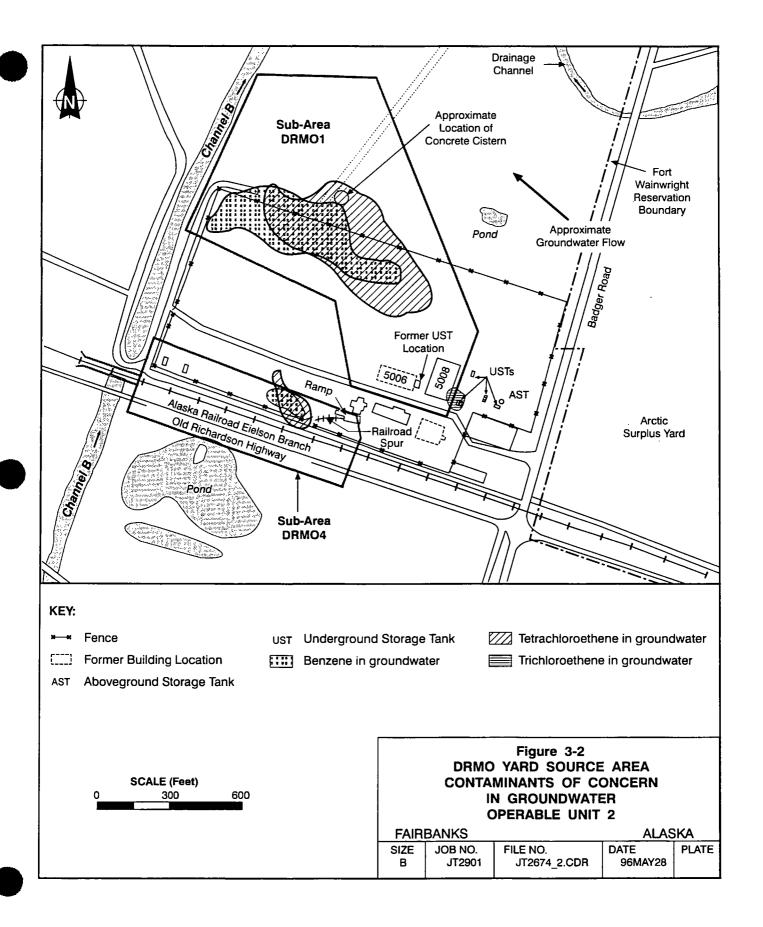
MEK = Methyl ethyl ketone.

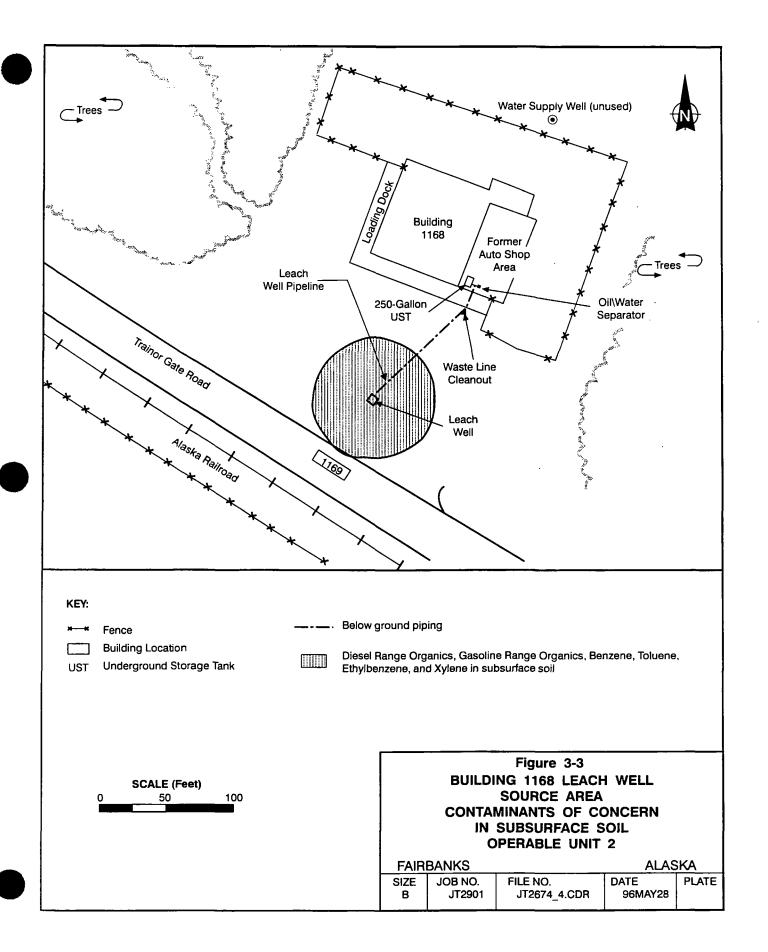
 $\mu g/L$ = Micrograms per liter.

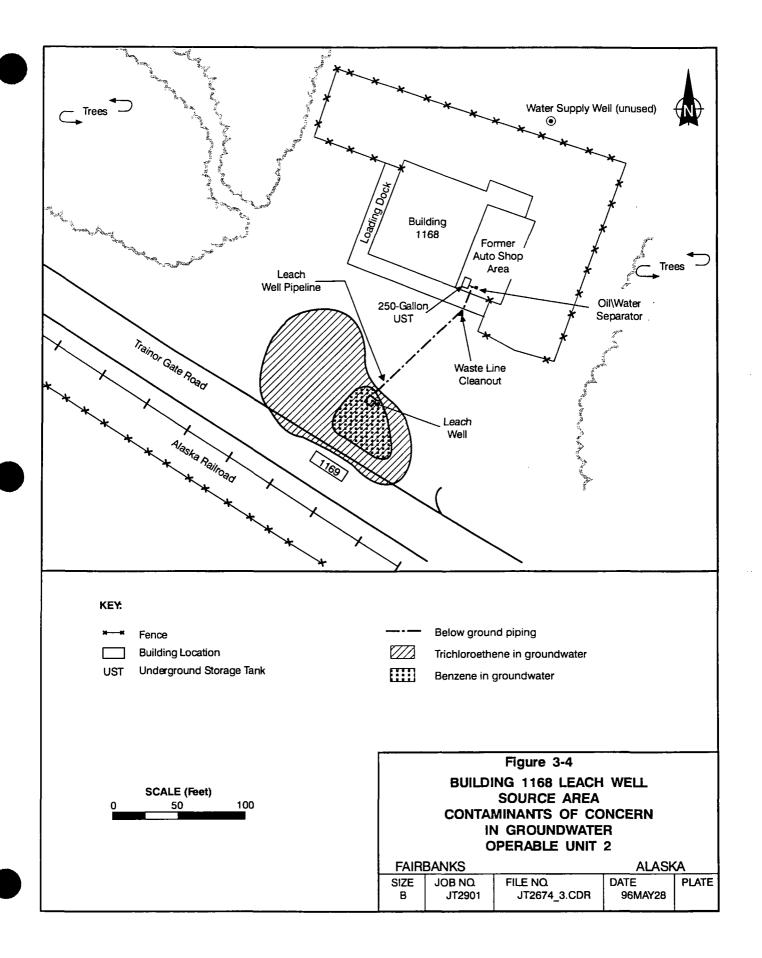
NA = Not applicable.

VOCs = Volatile organic compounds.









4.0 SUMMARY OF SITE RISKS

The Baseline Human Health and Ecological Risk Assessment is one mechanism for determining the need for taking action at the source areas and indicates exposure pathways that need to be addressed by remedial action. Risk Assessments are performed using information regarding contaminants and assumptions regarding the extent to which people may be exposed to them. This summary of the Baseline Human Health Risk Assessment for the source areas is divided into the five following sections:

- Identification of chemicals of potential concern;
- Exposure assessment;
- Toxicity assessment;
- Risk characterization, which is an integration and summary of the information gathered and analyzed in the preceding sections; and
- Analysis of the uncertainties involved in developing a Risk Assessment.

The summary concludes with the results of the Ecological Risk Assessment conducted for the DRMO Yard and Building 1168 Leach Well.

Human Health and Ecological Risk Assessments were conducted for OU-2 to determine potential risks in the absence of remedial action. CERCLA guidance allows the Baseline Human Health Risk Assessment to reflect the expected future use of a site. Scenarios involving future residential use of the DRMO Yard and Building 1168 Leach Well were completed; however, these scenarios were determined to not be appropriate for soils because industrial use is the reasonably anticipated future use, based on the Post Master Plan and historical use of both areas.

It was determined, because of site hydrological conditions, that future residential risks identified in the Baseline Human Health Risk Assessment apply to groundwater because an exposure pathway for domestic water users exists. The NCP requires that groundwater be returned to its beneficial uses whenever practicable. At these source areas, the beneficial use is domestic water supply.

4.1 IDENTIFICATION OF CONTAMINANTS OF CONCERN

Selection of contaminants of concern, which are chemicals that potentially contribute to human health risks at the source areas, was a three-step process. First, the maximum concentrations of contaminants detected in on-site soil and water during the RI field investigation were compared to health-based screening levels for soil and drinking water developed by EPA, Region 3, (April 20, 1994) and Region 10, Supplemental Risk Assessment Guidance. These standards reflect residential exposure assumptions of 1×10^{-6} and 1×10^{-7} risks associated with groundwater and soil, respectively, or a hazard quotient of 0.1 for all media. Secondly, inorganic chemicals were compared to naturally occurring background levels. If concentrations were found below established background levels, they were

eliminated from further consideration. Thirdly, chemicals detected at a frequency of less than 1% were eliminated from consideration unless their concentration was significantly higher than EPA's health-based screening levels. While soil contamination did not pose a direct threat to human health, it does act as an ongoing source of contamination to groundwater.

Table 4-1 presents the contaminants of concern identified in each environmental medium evaluated for each source area.

4.2 EXPOSURE ASSESSMENT

The exposure assessment estimates the type and magnitude of exposures to the contaminants of concern at the source areas. The exposure assessment considers the current and potential future uses of the source area, characterizes the potentially exposed populations, identifies the important exposure pathways, and quantifies the intake of each contaminant of concern from each medium for each population at risk. The Human Health Risk Assessment for OU-2 was completed for the DRMO Yard and Building 1168 Leach Well.

4.2.1 Identification of Site Uses, Exposed Populations, and Exposure Pathways

4.2.1.1 Source Area Land Use Scenarios

The exposure assessment for the DRMO Yard and Building 1168 Leach Well source areas considers land use scenarios to evaluate exposed populations. The Baseline Human Health Risk Assessment evaluated future residential land use of the site, which assumes that individuals would spend 30 years of their time at the source. Even though this scenario is unlikely, it provides a conservative baseline to avoid underestimation of risks. The industrial scenario assumes that the site would continue to be used for industrial purposes and that workers would spend 25 years of continuous employment at the site. Tables 4-2 and 4-3 identify the potential exposure routes evaluated for the Human Health Risk Assessment. It was determined that the industrial scenario would be appropriate for these source areas for the land use purposes. For groundwater, the future residential use scenario is used to represent the impacted drinking water supply aquifer and potential consumption.

4.2.1.2 Exposure Pathways and Assumptions

An exposure pathway is the mechanism by which chemicals migrate from their source or point of release to the population at risk. A complete exposure pathway comprises four elements: a source of a chemical release, transport of contaminants through environmental media, a point of potential human contact with a contaminated medium, and entry into the body or exposure route.

The exposure pathways considered in the Baseline Human Health Risk Assessment varied depending on the land use and population potentially exposed. The exposure assessment identified potential pathways for contaminants of concern to reach the exposed population for each source area. A "complete" exposure pathway must exist for a contaminant to pose a potential human health risk (i.e., the potential receptor to be exposed to a contaminant must exist).

4.2.1.3 Calculation of Exposure

EPA's Superfund guidance requires that the reasonable maximum exposure be used to calculate potential health impacts at Superfund sites. The reasonable maximum exposure is the highest exposure that is reasonably expected to occur at the source areas and is calculated using conservative assumptions in order to represent exposures that are reasonable and protective. The Baseline Human Health Risk Assessment reasonable maximum and average exposures were estimated for the residential and industrial land use scenarios. Average exposures were calculated to represent exposures of a more typical person.

To estimate exposure, data regarding the concentrations of contaminants of concern in the media of concern at the source area (the exposure point concentrations) are combined with information about the projected behaviors and characteristics of the people who potentially may be exposed to these media (exposure parameters). These elements are described below:

a) Exposure Point Concentrations. Surface soil (0 feet to 2 feet BGS), subsurface soil (2 feet to 12 feet BGS), and groundwater sample results for the DRMO Yard were averaged to calculate exposure point concentrations for the reasonable maximum exposure and average exposure calculations. At the DRMO Yard, two wells were selected from three areas (Area 1, Area 2, and Area 3) within the source area to be evaluated to ensure that the risks associated with "hot spots" were considered. Data from these areas were averaged to provide the reasonable maximum exposure. Because contaminant release occurred through a subsurface leach well at Building 1168, only subsurface soil contamination exists. Therefore, surface soil, sediment, and air exposure pathways risks were not calculated. Groundwater exposure point concentrations were calculated. Tables 4-4 through 4-7 contain exposure point concentrations for carcinogenic and noncarcinogenic contaminants of concern at both source areas. The exposure point concentrations were calculated on the arithmetic mean as the data (average) and as the 95% upper confidence level of the arithmetic mean of the data (reasonable maximum exposure).

Note: A value of one-half the detection limit was used for nondetect concentrations for soil and groundwater to calculate the exposure point concentration. Because of the large number of nondetects (between 75% and 95% of the samples for many chemicals), the calculated 95% upper confidence limits (UCLs) are generally representative of the mean concentration. In addition, the maximum detected concentration for many chemicals was often only one to two orders of magnitude greater than the mean concentration. This finding indicates that, in general, there was not a wide variability in the distribution of chemicals in the different media. Because of these reasons, the 95% UCLs for many of the chemicals detected in soil and groundwater at OU-2 are not substantially different from the mean concentration.

b) Exposure Parameters. The parameters used to calculate the reasonable maximum exposure include body weight, age, contact rate, frequency of exposure, and exposure duration. Exposure parameters were obtained from EPA, Region 10, Risk Assessment guidance (Region 10, Supplemental Risk Assessment Guidance for

Superfund [EPA 1991]). The default exposure factors were modified to reflect site-specific climatological and other factors at Fort Wainwright. Site-specific exposure assumptions were made for soil contact, including ingestion, dermal contact, and inhaling dust, based on snow cover half the year.

For all of the media, exposures were estimated assuming long-term exposures to source area contaminants.

4.3 TOXICITY ASSESSMENT

The baseline human health evaluation provides toxicity information for the chemicals of concern. Generally, cancer risks are calculated using toxicity factors known as *slope factors*, while noncancer risks rely on reference doses.

EPA developed slope factors for estimating lifetime cancer risks associated with exposure to potential carcinogens. Slope factors are expressed in units of (milligrams per kilogram [mg/kg]-day⁻¹) and are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day⁻¹, to provide an upperbound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term *upperbound* reflects the conservative estimate of the risks calculated from the slope factor. Use of this approach makes it highly unlikely that the actual cancer risk would be underestimated. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which mathematical extrapolations from high to low dose and from animal to human dose have been applied.

Reference doses were developed to indicate the potential for adverse health effects from ingestion of potential contaminants of concern that exhibit such noncancer effects as damage to organ systems (e.g., the nervous system and blood forming system). Reference doses also are expressed in units of mg/kg-day and are estimates within an order of magnitude of lifetime daily exposure levels for people, including sensitive individuals, who are likely to be without risk of adverse effect. Estimates of intakes of contaminants of concern from environmental media (e.g., the amount of a contaminant of concern ingested from contaminated drinking water) can be compared to the reference dose. Reference doses are derived from human epidemiological studies and from animal studies to which uncertainty factors have been applied.

The toxicity factors were drawn from the Integrated Risk Information System or, if no Integrated Risk Information System values were available, from the Health Effect Assessment Summary Tables. For chemicals that do not have toxicity values available, other criteria, such as state and federal MCLs, were used to assess potential hazards or to determine action levels.

4.4 RISK CHARACTERIZATION

The purpose of the risk characterization is to integrate the results of the exposure and toxicity assessments to estimate risk to humans from exposure to site contaminants. Risks were calculated for carcinogenic (cancer-causing) and noncarcinogenic (toxic) effects based on the reasonable maximum exposure (see Section 4.2). To estimate cancer risk, the slope factor is multiplied by the exposure expected for that chemical to provide an upperbound estimate of

the excess lifetime cancer risk. This estimate is the incremental probability of an individual developing cancer over a lifetime as a result of exposure to cancer-causing chemicals at a source area. EPA considers excess lifetime cancer risks between 1 in 1 million (1×10^6) and 1 in 10,000 (1×10^4) to be within the generally acceptable range; risks greater than 1 in 10,000 usually suggest the need to take action at a site.

In defining effects from exposure to noncancer-causing contaminants, EPA considers acceptable exposure levels as those that do not adversely affect humans over their expected lifetime, with a built-in margin of safety. Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as a hazard quotient, which is the ratio of the estimated exposure from a site contaminant to that contaminant's reference dose. If the hazard quotient is less than 1, then adverse noncancer health effects are unlikely to occur. Hazard quotients for individual contaminants of concern are summed to yield a hazard index for the sub-area. The potential excess lifetime cancer risks and hazard indices described in this summary were calculated using reasonable maximum exposure assumptions.

Under current land use conditions, the estimates of carcinogenic and noncarcinogenic effects for the DRMO Yard fell within or below the EPA acceptable risk range for CERCLA sites. A current land use scenario was not evaluated for the Building 1168 Leach Well because there were no complete exposure pathways.

The future land use for both source areas is considered to be industrial. However, a residential scenario for groundwater is considered appropriate and representative of risk to current downgradient users, given DRMO Yard and Building 1168 Leach Well site hydrological conditions and the presence of the potable water supply/fire suppression well within the DRMO Yard. When considering groundwater as a source of domestic water, manganese was detected in groundwater at concentrations above EPA's acceptable risk range at the Building 1168 Leach Well. However, the manganese concentrations detected at the Building 1168 Leach Well are considered reflective of background concentrations in this mineral-rich area and are consistent with concentrations found in other source areas throughout Fort Wainwright.

Excess lifetime incremental cancer risks and hazard indices for both source areas are summarized in Tables 4-8 and 4-9. The incremental risks and hazard indices are calculated after subtracting the background concentrations of inorganics.

While soil contaminant concentrations do not pose a hazard for direct human contact, the levels are high enough to pose an ongoing threat to groundwater. Existing groundwater contaminant concentrations exceed state and federal MCLs.

4.4.1 Defense Reutilization and Marketing Office Yard

Excess lifetime incremental cancer risks for soil are below the 1 in 10,000 to 1 in 1 million risk range at the DRMO Yard, with the exception of benzo(a)pyrene, which is within the EPA acceptable risk range. Incremental hazard indices for soil at the DRMO Yard are less than 1. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of 1×10^{-6} for site workers and future residents. The average background concentration of arsenic in soil is higher than the estimated surface soil reasonable maximum exposure,

indicating that the arsenic risk for soil is attributable to background concentrations.

Excess incremental lifetime cancer risks for groundwater are below or within EPA's acceptable risk range of 1 in 10,000 to 1 in 1 million at the DRMO Yard. However, groundwater near the DRMO Yard groundwater supply/fire suppression well is contaminated with PCE at concentrations approaching unacceptable excess lifetime cancer risks (8.7×10^{-5}) . VOCs are the contaminants responsible for exceedance of a 1×10^{-6} risk for future residential use of groundwater. The incremental hazard index for groundwater at the DRMO Yard is less than 1.

State and federal MCLs for PCE and TCE are exceeded consistently in sub-area DRMO1 groundwater. State and federal MCLs for benzene and PCE are exceeded in sub-area DRMO4 groundwater.

4.4.2 Building 1168 Leach Well

Excess lifetime incremental cancer risks for groundwater are below or within the 1 in 10,000 to 1 in 1 million risk range at the Building 1168 Leach Well. Arsenic was the main contaminant responsible for exceedance of an excess lifetime cancer risk of 1×10^{-6} .

The average incremental hazard index for future groundwater use is less than 1; however, the reasonable maximum exposure hazard index is 7.8. Manganese is the main contaminant contributing to the elevated hazard index. However, manganese was not used and was not a by-product of any process conducted at the Building 1168 Leach Well.

4.5 MAJOR UNCERTAINTIES

Uncertainty is associated with every step of the Risk Assessment process. The main uncertainty associated with the OU-2 Human Health Risk Assessment process that could result in overly conservative risk evaluation is summarized below:

• EPA recommends use of a default value of 30 years for residential exposure; however, most military assignments are for a much shorter period of time, often only one to three years.

Uncertainties that may underestimate site-related risk and exposures include the following:

- As a result of a data review reported by one laboratory, many pesticide and PCB data points were rejected for data quality reasons. However, these rejections do not appear to significantly affect the Risk Assessment; and
- Some of the analyses performed (diesel-range organics, gasoline-range organics, and total petroleum hydrocarbons) do not provide chemicalspecific data; therefore, associated risks could not be quantified. However, surrogate chemicals were evaluated.

Uncertainties with unknown effects on the outcome of the Human Health Risk Assessment include the following:

- Multiple laboratories were used to analyze OU-2 samples, which can lead to inconsistencies in approach and can introduce errors or laboratory artifacts not easily identified;
- Surrogate toxicity factors were used to evaluate the potential risk associated with structurally similar chemicals that lack EPA-verified toxicity factors (e.g., naphthalene was used as a surrogate for methylnaphthalene). However, it was impossible to identify appropriate surrogates for all chemicals lacking verified toxicity factors. Therefore, certain chemicals were not evaluated in the Risk Assessment.
- The quality assurance/quality control process identified some concerns with regard to analytical results for organochlorine and organophosphorus pesticide samples. After data concerns were raised for OU-2 pesticide analytical results, separate independent reviews of the data were conducted by the Army; United States Army Engineer District, Alaska; and EPA. While the conclusions of both reviews indicate that the data are usable and consistent with other quality assurance laboratory analyses, uncertainty remains. However, to provide perspective, the action/no action decisions in this Record of Decision would not change even if the results were an order of magnitude different than those reported. The variability of results Is not expected to exceed this estimate, even under worst-case conditions.

Because numerous conservative assumptions were used in the selection of contaminants of concern and the exposure and toxicity assessments, the risk characterization results likely overestimate risks associated with contaminants of concern at OU-2.

4.6 ECOLOGICAL RISKS

An Ecological Risk Assessment addresses the impacts and potential risks posed by contaminants to natural habitats, including plants and animals, in the absence of remedial action. The three main phases of the Ecological Risk Assessment are problem formulation, analysis, and risk characterization.

The following sections present a brief discussion of the Ecological Risk Assessment steps.

4.6.1 Problem Formulation

To narrow the scope and to focus the Ecological Risk Assessment on the most important aspects of OU-2, a number of steps was performed. An ecological survey was conducted at the DRMO Yard and Building 1168 Leach Well. In addition, previous ecological investigations, including wildlife inventories, were reviewed. A description of the regional and local ecology was completed, and threatened, endangered, sensitive, or rare species were

identified.

Chemicals of potential ecological concern were identified by a review of the OU-2 analytical database with regard to data quality, spatial representation and adequacy for an Ecological Risk Assessment, comparison to background concentrations, and comparison to ecological risk-based criteria for sediment and surface water. Next, pathways of contaminant migration exposure were identified by an evaluation of sources of contaminants and the mechanisms by which they may be transported to media of ecological concern, plants, and animals.

Potential ecological effects are summarized by a review of the toxicological literature. These summaries present a review of the known toxicological effects of the chemicals of potential ecological concern on wildlife species.

Two types of ecological end points are considered in the Ecological Risk Assessment: assessment and measurement end points:

- Assessment end points are qualitative or quantitative expressions of the
 environmental values to be protected at OU-2 and are selected by
 consideration of species that play important roles in community
 structure or function; species of societal significance or concern;
 species of concern to federal and state agencies; diet, habitat
 preference, and behaviors that predispose the species to chemicals of
 potential ecological concern exposure; amenability of the selected
 species to measurement or prediction of effects; and species that may
 be particularly sensitive to the chemicals of potential ecological concern
 identified at OU-2; and
- Measurement end points include the species and communities used to quantify the potential ecological impacts posed by OU-2 chemicals of potential ecological concern. Representative measurement species are selected based on the relative abundance of each species and establishment of functional groups based on trophic level and preferred habitat. Representative indicator species then are selected based on the potential for exposure and the availability of toxicological data. The following measurement species and communities were selected for evaluation at OU-2: meadow voles, muskrats, and benthic invertebrates.

A conceptual ecological exposure model is formulated and defines the receptors and pathways to be evaluated in the Ecological Risk Assessment. The refined conceptual ecological exposure models for OU-2 are potential ecological risks that may result from exposure of terrestrial wildlife and vegetation to chemicals of potential ecological concern found in the surface soils at the DRMO Yard and from exposure of benthic invertebrates to sediments and surface water associated with the DRMO Yard. No complete ecological exposure pathways associated with the Building 1168 Leach Well were identified; therefore, the source area was not evaluated further.

4.6.2 Analysis

The analysis phase of the Ecological Risk Assessment evaluates receptor exposure to chemicals of potential ecological concern and the potential adverse effects of that exposure. Analysis of exposure and effects is based on the ecological end points and the refined conceptual ecological exposure site model derived during the problem formulation phase. Analysis comprises two main components:

- Exposure assessment, in which exposure point concentrations and chemical of potential ecological concern intakes for the measurement species are estimated; and
- Ecological effects assessment, in which toxicity benchmark values are
 derived from the literature and toxicological databases, and uncertainty
 factors are selected and applied to the toxicity benchmark values to
 yield toxicity reference values. The uncertainty factors are used to
 compensate for applying data derived from laboratory or domestic
 animal studies to free-ranging wildlife (for which little empirical data
 are available).

4.6.3 Risk Characterization

Risk characterization involves two major components: risk estimation and risk description.

4.6.3.1 Risk Estimation

Risk estimation involves calculating hazard quotients to assess potential ecological risks to measurement species and communities. This method involves comparing calculated exposure doses or media concentrations with toxicity reference values and/or experimentally derived risk-based concentrations. Ecological effects are quantified by calculating the ratio between a chemical of potential ecological concern's estimated intake or concentration and its corresponding toxicity reference value (i.e., the intake level or concentration at which no adverse ecological effects are expected to occur). If this ratio (i.e., the hazard quotient) exceeds 1, then adverse ecological effects may be expected for the chemical of potential ecological concern. The hazard quotients described in this summary were calculated using conservative reasonable maximum exposure assumptions.

The hazard quotients for each exposure pathway (e.g., soil ingestion and surface water ingestion) may be summed for each chemical of potential ecological concern to establish chemical-specific hazard indices for each measurement species. The hazard indices provide a species- and chemical-specific characterization of the potential ecological risks across all of the assessed exposure pathways. Finally, the hazard indices can be added across contaminants that have similar effects.

4.6.3.2 Risk Description

Risk description involves summarizing the ecological significance of the potential risks and presenting the uncertainties associated with the Ecological Risk Assessment.

The results of the Ecological Risk Assessment for OU-2 indicate a potential for adverse effects to small terrestrial mammals (e.g., voles) at the DRMO Yard, reflecting ecologically significant concentrations of manganese and lead. These risks are associated with ingestion of soil and vegetation. These contaminants do not appear to be associated with historical source area activities and are consistent with regional background concentrations. Additionally, the DRMO Yard is an industrial area with a significant amount of heavy equipment and human activity. The habitat area in these locations has been altered significantly from the surrounding land. Specific species surveys and traps were not used. The actual number of animals that could be affected by these chemicals could be very low.

At the DRMO Yard drainage ditches, muskrats may be impacted by lead, manganese, arsenic, dioxin, and PCBs present in the sediments; however, the east drainage ditch containing the PCBs and dioxins was excavated in 1995. For the purposes of the Ecological Risk Assessment, it was assumed that the muskrat would remain year-round in the surface water bodies at the DRMO Yard. This is a conservative assumption because muskrats are known to migrate to larger water bodies during winter, when smaller water bodies freeze. Therefore, the risk is overestimated. In addition, impacts to the muskrat population are not expected because the affected areas are limited in size.

Sediment quality criteria are a measure of the potential adverse effects to benthic invertebrates. Organic chemicals of potential ecological concern, lead, and cadmium exceed the sediment quality criteria in the east ditch. However, the east ditch is dry throughout most of the year and therefore does not support aquatic life. In addition, this ditch was excavated in 1995. Although the sediment quality criteria were exceeded for arsenic, manganese, and lead in Channel B and the north channel at the DRMO Yard, the origin of these inorganic chemicals is assumed to be attributable mainly to a combination of naturally occurring concentrations, contributions from other anthropogenic sources, and diffuse nonpoint source input from the DRMO Yard source area.

Overall, there do not appear to be unacceptable potential ecological risks associated with the DRMO Yard source area.

The Ecological Risk Assessment is subject to uncertainties because virtually every step in the Risk Assessment process involves assumptions using professional judgment. Principal uncertainties associated with the OU-2 Ecological Risk Assessment include the following:

- Site and media with incomplete exposure pathways were eliminated from evaluation;
- For terrestrial species, the risks were estimated using average site chemical concentrations in soil between 0 feet and 2 feet BGS and modeled chemical concentrations in plants for the meadow vole;
- For aquatic species, risks were estimated by calculating hazard indices for muskrats potentially exposed to chemicals of potential ecological concern in sediments and plants, and by evaluating the potential adverse effects to benthic invertebrates by comparing sediment chemicals of potential ecological concern to sediment quality criteria;

- Sampling was biased toward areas of "expected" soil contamination.
 This is likely to result in an overestimation of potential risks to the OU-2 ecological receptors;
- Conservative assumptions were used in estimating exposures and in developing the contaminant screening criteria (such as using the lowest no observed adverse effect level value from the literature), which tend to overestimate risks:
- Indicator species were selected on the basis of likelihood of exposure to contaminants. Exposure of other terrestrial and aquatic receptors is not expected to exceed these risks. Conservative assumptions were used in the selection of the indicator species to minimize the potential for underestimating the exposure to other unevaluated receptors;
- Exposure parameters for all measurement species were selected based on professional judgment. Assumptions included the following: that chemicals do not degrade, terrestrial receptors are exposed chronically to the mean concentration of all chemicals of potential ecological concern in soil and sediment, receptors spend their lifetime within the contaminated portion of the site, contaminants are absorbed completely via all evaluated exposure routes, chemicals do not combine to form new chemicals, and plant uptake modeling accurately describes chemical uptake in plants. Without extensive site-specific field data, it is unclear whether potential risks are underestimated or overestimated using the selected exposure parameters;
- Assumptions used in the effects assessment include the following: use of animal data can be extrapolated across species, laboratory species have sensitivity to chemicals of potential ecological concern similar to species in the natural environment, data for reproductive and development end points can predict impacts to populations, oral exposure toxicity values can be used to evaluate dermal exposure, indicator species are as sensitive to the toxic effects of chemicals of potential ecological concern as the other species on site, and the toxicity benchmarks adequately address the potential toxicity of chemicals of ecological concern to relevant species. It is unclear whether these assumptions overestimate or underestimate potential risks; and
- Chemicals with different target organs and end points add linearly to potential risks. This assumption probably results in an overestimation of risk.

The approach described in this Ecological Risk Assessment uses realistic assumptions wherever possible; reasonable and conservative assumptions were used when empirical data were unavailable. Consequently, potential ecological risks to OU-2 species are more likely to be overestimated rather than underestimated.

CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Source Area					
	DRMO	Building 1168 Leach Well				
Chemical	Groundwater	Soil	Groundwater			
Aroclor 1260		х				
Arsenic		x	x			
Barium	x		x			
Benzene	x		x			
Benzo(a)anthracene		x				
Benzo(a)pyrene		x				
Benzo(b)fluoranthene		х				
n-Butylbenzene	х		х			
sec-Butylbenzene	х		х			
Cadmium		х				
Chloroform	х					
Chromium	х					
4,4'-DDT		x				
1,2-Dichlorobenzene	х					
1,1-Dichlorobenzene	х					
1,2-Dichloroethane	х					
1,2(cis)-Dichloroethene	х					
Dieldrin		X_				
Diesel-range organics	х	х	х			
Disulfoton	х					
Ethylbenzene			х			
Gasoline-range organics	х	х	x			
Indeno(1,2,3-cd)pyrene		х				
Lindane		х				
Manganese	х	х	x			

Key at end of table.

CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER FROM THE HUMAN HEALTH RISK ASSESSMENT OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Source Area					
	DRMO	Yard	Building 1168 Leach Well			
Chemical	Groundwater	Soil	Groundwater			
Mercury		Х				
Methylene chloride	х					
2-Methylnaphthalene	х					
2,3,7,8-TCDD (as TEQs)	Х	x				
Tetrachioroethene	х					
Toluene			X			
Trichloroethene	х		X			
o-Xylene	х		х			

Key:

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

X = Indicates that the chemical was selected as a chemical of concern for the specific site and media shown.

POTENTIAL EXPOSURE ROUTES DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Potentially Exposed Populations					
Exposure Medium and Route	Current Worker	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor	
Groundwater						
Ingestion	х	х	X		_	
Dermal contact	X	х	Х	<u> </u>	_	
Air						
Inhalation of VOCs	<u>-</u>		X			
Inhalation of particulates	x	X	-	_		
Soil						
Ingestion	X	Х	_	_	_	
Dermal contact	x	Х			_	

Key:

- = Exposure of this population through this route is not likely to occur.

DRMO = Defense Reutilization and Marketing Office.

VOCs = Volatile organic compounds.

X = Exposure of this population through this route is probable.

POTENTIAL EXPOSURE ROUTES BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

	Potentially Exposed Populations				
Exposure Medium and Route	Future Worker	Future Resident	Future Construction Worker	Future Site Visitor	
Groundwater					
Ingestion	_	х	_	-	
Dermal contact	-	х	_		
Air					
Inhalation of VOCs	-	х	_	_	

Key:

- = Exposure of this population through this route is not likely to occur.

VOCs = Volatile organic compounds.

X = Exposure of this population through this route is probable.

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2

FORT WAINWRIGHT, ALASKA

(mg/kg)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.004	0.12	0.013	0.006
4,4'-DDT	0.055	1.1	0.0129	. 0.079
Aroclor 1260	0.113	1.1	0.156	0.143
Arsenic	8.37	72.4	7.904	9.85
Benzo(a)anthracene	0.150	0.32	58.557	160.97
Benzo(a)pyrene	0.153	0.35	60.802	164.77
Benzo(b)fluoranthene	0.125	0.35	57.736	136.31
Cadmium	0.68	8.1	1.044	0.88
Dieldrin	0.014	1.0	113.058	35.66
Diesel-range organics	55.682	2,000	251.039	103.402
Gasoline-range organics	4.62	130	15.098	7.49
Indeno(1,2,3-cd)pyrene	0.098	0.2	0.046	0.106
Lead	35.46	996	111.649	56.27
Lindane	0.002	0.004	0.0007	0.002
Manganese	263.56	440	77.887	278.27
Mercury	0.05	0.32	0.040	0.06
p-lsopropyltoluene	0.003	0.051	0.006	0.004
Thallium	0.12	0.13	0.027	0.12
2,3,7,8-TCDD (TEQs)	2.54 pg/g	97.4 pg/g	11.460	4.77 pg/g

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide surface soil data.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

mg/kg = Milligrams per kilogram. pg/g = Picograms per gram.

RME = Reasonable maximum exposure.
TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY CHEMICALS OF POTENTIAL CONCERN SUBSURFACE SOIL AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

(mg/kg)

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,3,5-Trimethylbenzene	0.0543	5.600	0.457	0.104
4,4'-DDT	0.0120	0.380	0.029	0.015
Aroclor 1260	0.0790	0.590	0.047	0.085
Arsenic	5.38	19.6	3.643	5.78
Benzo(a)anthracene	0.0409	0.045	0.009	0.042
Benzo(a)pyrene	0.0441	0.049	0.011	0.045
Benzo(b)fluoranthene	0.0432	0.048	0.010	0.044
Cadmium	0.42	2	0.311	0.46
Dieldrin	0.0016	0.013	0.001	0.002
Diesel-range organics	114.19	9,600	732.435	194.586
Gasoline-range organics	16.04	690	63.206	22.98
Lead	7.59	130	9.326	8.60
Lindane	0.004	0.130	0.009	0.004
Manganese	235.89	2,420	210.473	258.88
Mercury	0.06	2.3	0.152	0.07
p-Isopropyltoluene	0.025	2.200	0.172	0.044
Thallium	2.24	9.8	1.388	2.39
2,3,7,8-TCDD (TEQs)	0.350 pg/g	1.73 pg/g	1.914	0.584

Note: The average and RME concentrations represent the arithmetic mean and the 95% UCL calculated on the sitewide subsurface soil data.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

DDT = Dichlorodiphenyldichloroethane.

DRMO = Defense Reutilization and Marketing Office.

mg/kg = Milligrams per kilogram.

pg/g = Picograms per gram.

RME = Reasonable maximum exposure. TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

EXPOSURE POINT AND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2

FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
1,2,4-Trimethylbenzene	15.881	460	65.375	27.837	310.000	ND	1.15
1,2-Dichlorobenzene	2.962	38	3.805	3.462	ND	ND	ND
1,2-Dichloroethane	0.524	1.5	0.154	0.552	ND	ND	ND
1,3,5-Trimethylbenzene	6.845	130	22.937	11.04	95.500	ND	1.05
1,4-Dichlorobenzene	2.716	12	2.365	3.027	ND	ND	ND
2-Methylnaphthalene	15.539	240	39.433	23.084	155.000	1_	ND ND
Barium (total)	176	1,200	150	205	255	165	705
Benzene	0.825	7.5	1.226	1.049	ND	ND	6.7
Butylbenzene(sec)	1.276	25	3.141	1.850	18.0	3.2	ND
Chloroform	1.218	8	1.537	1.449	1.100	ND	ND
Chromium (total)	25	510	69	39	ND	ND	160
cis-1,2-Dichloroethene	0.644	7.3	0.802	0.791	ND	ND	ND
Diesel-range organics	2,613	41,000	7,474	3,856	32,000	2,700	250
Disulfoton	0.122	1.3	0.146	0.150	ND	0.315	ND
Gasoline-range organics	531	28,000	3,113	1,104	14,470	250	235

Key at end of table.

EXPOSURE POINT AND STATISTICAL SUMMARY OF CHEMICALS OF POTENTIAL CONCERN FOR GROUNDWATER AT THE DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL	RME Area 1	RME Area 2	RME Area 3
Manganese (total)	1,648	13,000	1,822	1,997	8,000	3,150	950
Methylene chloride	0.885	8.8	1.220	1.109	ND	ND	ND
n-Butylbenzene	0.913	30	3.253	1.508	15.250	ND	ND
Naphthalene	16.786	530	64.905	25.306	204.000	ND	ND
o-Xylene	6.477	170	26.250	11.277	119.500	ND	ND
p-Isopropyltoluene	4.004	200	22.095	8.045	109.500	ND	ND
Tetrachloroethene	5.995	140	18.375	9.355	ND	102.5	26.8
Trichloroethene	1.857	17	2.884	2.385	ND	3.4	3.7
2,3,7,8-TCDD (TEQs)	9.30E-7	8.65E-6	1.599	1.21E-6	4.30E-7	1.24E-6	9.11E-7

Notes: Area 1 RME represents the average of monitoring wells P34 and AP-5825, the wells with the highest number of maximum detections.

Area 2 RME represents the average of monitoring wells MW4 and P46, the area of maximum tetrachloroethene concentrations.

Area 3 RME represents the average of monitoring wells P04 and P05, the area of maximum benzene concentrations.

Table 4-6 (Cont.)

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

COPC = Chemical of potential concern.

DRMO = Defense Reutilization and Marketing Office.

 $\mu g/L$ = Micrograms per liter.

ND = Not detected.

RME = Reasonable maximum exposure.

TCDD = Tetrachlorodibenzo-p-dioxin.

TEQs = Toxicity equivalencies.

EXPOSURE POINT CONCENTRATION AND STATISTICAL SUMMARY OF CONTAMINANTS OF POTENTIAL CONCERN FOR GROUNDWATER AT BUILDING 1168 LEACH WELL OPERABLE UNIT 2

FORT WAINWRIGHT, ALASKA

 $(\mu g/L)$

Chemical	Sitewide Average Concentration	Maximum Detected Concentration	Standard Deviation	RME 95% UCL
1,2,4-Trimethylbenzene	95.22	350	145.940	234.368
1,3,5-Trimethylbenzene	40.78	150	62.427	100.302
Arsenic	8.63	27	103	185
Barium	238	350	0.100	0.334
Benzene	2.12	5.1	1.733	3.772
Diesel-range organics	7,316	34,000	14,940	21,561
Ethylbenzene	87.32	310	130.681	211.919
Gasoline-range organics	4,365	18,000	7,669	11,677
Manganese (dissolved)	1,682	4,400	1,716.601	3,318.710
n-Butylbenzene	6.77	16	7.557	13.975
o-Xylene	201.62	1,000	446.309	627.158
p-lsopropyltoluene	11.24	30	11.903	22.589
sec-Butylbenzene	4.8	11	4.139	8.747
Toluene	154.8	770	343.907	482.702
Trichloroethene	5.56	23	9.749	14.856

Notes:

Both the average and RME concentrations represent the arithmetic mean and the 95% UCL of the five wells located closest to the leach well: AP-5747, -5751, -5752, -5754, and -6332.

Although cadmium was retained as a COPC based on the screening for all wells at Building 1158, cadmium was not detected in any of the five wells included in the EPC calculations.

Key:

95% UCL = 95% upper confidence limit on the arithmetic mean.

COPC = Chemical of potential concern. EPC = Exposure point concentration.

 μ g/L = Micrograms per liter.

RME = Reasonable maximum exposure.

SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT THE DRMO YARD OPERABLE UNIT 2

FORT WAINWRIGHT, ALASKA

	Carcinogeni	c Risks	Noncarcinogenic H	lazard Indices		
Receptor/Pathway	Average	RME	Average	RME		
Surface soil ingestion	1.9E-08	3.4E-07	1.1E-04	6.9E-04		
Surface soil dermal contact	1.0E-08	1.2E-06	3.3E-05	1.9E-03		
Total	3.0E-08	1.5E-06	1.4E-04	2.6E-03		
Future Resident-Sitewide			-			
Surface soil ingestion	4.6E-07	3.1E-06	8.4E-04	5.3E-03		
Surface soil dermal contact	7.0E-09	2.0E-06	2.5E-05	2.8E-03		
Total	4.7E-07	5.1E-06	8.6E-04	8.1E-03		
Future Resident—Sitewide						
Groundwater ingestion	5.5E-07	1.0E-05	3.4E-02	7.1E-01		

Notes:

Incremental risks are presented for only those receptors exceeding a total risk of 10⁻⁶ or a total hazard index of 1.0. Incremental risks are not presented for the three areas with elevated chemical concentrations.

Incremental risks are calculated after subtracting the background concentrations of inorganics.

Arsenic was not a chemical of potential concern in groundwater. Therefore, the groundwater-related incremental risks are identical to the total risks.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Building 1168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Building 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

Table 4-8 (Cont.)

Key:

DRMO = Defense Reutilization and Marketing Office.

OU = Operable Unit.

PCE = Tetrachloroethene.

RI = Remedial Investigation.

RME = Reasonable maximum exposure.

SUMMARY OF INCREMENTAL CARCINOGENIC RISKS AND NONCARCINOGENIC HAZARD INDICES FOR POTENTIALLY EXPOSED POPULATIONS AT BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2

FORT WAINWRIGHT, ALASKA

	Carcinogenic Risks		Noncarcino Hazard In	_			
Receptor/Pathway	Average	RME	Average	RME			
Future Resident							
Groundwater ingestion	1.1E-07	3.2E-06	2.0E-02	7.5E+00			
Groundwater dermal contact	3.2E-11	3.6E-10	2.0E-05	7.6E-05			
Groundwater inhalation of VOCs	8.4E-08	2.3E-06	2.7E-02	2.8E-01			
Total	1.9E-07	5.5E-06	4.7E-02	7.8E+00			

Note: Incremental risks are calculated after subtracting the background concentrations of inorganics.

The soil and groundwater for OU-2 source areas was reviewed to identify whether hotspots (ares with chemical concentrations significantly elevated above that detected across the rest of the site) were present. There were no clearly discernible hotspots in soil at the DRMO Yard. Three potential groundwater hotspots were identified at the DRMO Yard. Data from two monitoring wells at each hotspot were evaluated independently from the sitewide groundwater database. The Area 1 hotspot included 19 of the maximum detected groundwater concentrations at the DRMO Yard. Areas 2 and 3 represented PCE and benzene hotspots, respectively. Potential human health risks associated with exposure to these hotspots was evaluated separately. Eleven monitoring wells were sampled during the RI at the Building 1168 source area. A subset of the five wells closest to the leachfield source were evaluated in the Risk Assessment. The other six wells were somewhat distant from the Building 1168 source area and did not appear to be impacted significantly by source area chemicals. As a result, the Risk Assessment is based on a grouping of wells that represent the highest concentrations from the Building 1168 source area. Exposure to soil at Building 1168 was not evaluated in the Risk Assessment because of the nature of the release (into deep subsurface soil) and the limited soil data collected during the RI.

Key:

OU = Operable Unit.

PCE = Tetrachloroethene.

RI = Remedial Investigation.

RME = Reasonable maximum exposure.

VOCs = Volatile organic compounds.

5.0 DESCRIPTION OF ALTERNATIVES

5.1 NEED FOR REMEDIAL ACTION

Remedial actions were deemed necessary with respect to groundwater at the DRMO Yard and Building 1168 Leach Well to comply with state and federal MCLs.

Actual or threatened releases of hazardous substances from the DRMO Yard and Building 1168 Leach Well source areas, if not addressed, may present substantial endangerment to public health, welfare, or the environment.

Groundwater is the only source of potable water for Fort Wainwright and surrounding communities. The aquifer is considered unconfined except in areas of permafrost. Additionally, the aquifer is considered highly transmissive, with large hydraulic conductivities. Remedial actions for soils were selected to remove volatile organic and petroleum compounds from the soils as quickly as possible in order to minimize soils acting as an ongoing source of contamination to the groundwater.

5.1.1 Defense Reutilization and Marketing Office Yard

The specific reasons for conducting remedial actions at the DRMO Yard source area are provided below, with the main focus being protection of groundwater:

- VOCs (i.e., benzene, PCE, and TCE) in groundwater at the DRMO
 Yard are present at concentrations above state and federal MCLs; and
- VOC- (e.g., PCE, benzene, and TCE) contaminated soils from unknown sources (within an identified area) are a continuing source of groundwater contamination, as discussed in the nature and extent section.

Petroleum-contaminated subsurface soils act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for UST petroleum-contaminated soil.

Many chemicals were detected at the DRMO Yard; however, the above-listed VOCs and petroleum-related compounds were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Contamination related to petroleum, including DRO/GRO, has been referred to the Two-Party Agreement, except in instances where it is comingled with other contaminants of concern. Table 5-1 provides the rationale for discarding and retaining chemicals detected at the DRMO Yard source area.

5.1.2 Building 1168 Leach Well

The specific reasons for conducting remedial actions at the Building 1168 Leach Well source area are provided below, with the main focus being protection of groundwater:

- VOCs (benzene and TCE) in groundwater near the Building 1168
 Leach Well are present at concentrations exceeded state and federal MCLs; and
- VOC-contaminated subsurface soils are a continuing source of groundwater contamination.

Petroleum-contaminated subsurface soils, including DRO/GRO, act as a continuing source of groundwater contamination because of shallow aquifer conditions and annual groundwater fluctuations. These contaminants are present at concentrations above State of Alaska cleanup levels for non-UST petroleum-contaminated soil.

Other chemicals were detected at the Building 1168 Leach Well source area; however, the above-listed VOCs and petroleum-related contaminants were the only chemicals to exceed regulatory limits or to act as significant sources of risk to human health or the environment. Table 5-2 provides the rationale for discarding and retaining chemicals detected at the Building 1168 Leach Well.

5.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are based on federal and state applicable or relevant and appropriate requirements (ARARs). All groundwater RAOs are based on state and federal MCLs. Soil RAOs are based on State of Alaska cleanup levels for non-UST petroleum contamination. The RAOs for the DRMO Yard and Building 1168 Leach Well are as follows:

Groundwater

- Restore groundwater to its beneficial use of drinking water quality within a reasonable time frame through source control;
- Reduce or prevent further migration of contaminated groundwater from the source areas;
- Prevent use of groundwater containing contaminants at levels above Safe Drinking Water Act and State of Alaska Drinking Water Standard MCLs and Alaska Water Quality Standards (AWQS), and limit highvolume pumping from the aquifer at the DRMO Yard until state and federal MCLs are achieved; and
- Use natural attenuation to attain AWQS (18 Alaska Administrative Code [AAC] 70) after reaching state and federal MCLs.

Soil

 Prevent migration of soil contaminants to groundwater, which could result in groundwater contamination and exceedances of state and federal MCLs and AWQS (18 AAC 70).

5.3 SIGNIFICANT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

A full list of ARARs is in Section 8. The following ARARs are the most significant regulations that apply to the remedy selections for the DRMO Yard and Building 1168 Leach Well:

- State and federal MCLs are relevant and appropriate for groundwater.
 These set the active remediation goals for groundwater. AWQS (18 AAC 70) is also applicable; and
- Alaska oil pollution regulations (18 AAC 75) are applicable, and Alaska guidelines for non-UST petroleum-contaminated soil are to be considered. These guidelines require cleanup of petroleumcontaminated soils to protect groundwater quality.

5.4 DESCRIPTION OF ALTERNATIVES

5.4.1 Defense Reutilization and Marketing Office Yard

Preliminary remedial alternatives for the DRMO Yard are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow direction.

5.4.1.1 Alternative 1: No Action

The no-action alternative for the DRMO Yard source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated groundwater in its present state. The groundwater plume would continue to migrate in the direction of groundwater potentially migrating to the Chena River. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth, capital, operation and maintenance (O&M), or groundwater monitoring costs are associated with this no-action alternative.

5.4.1.2 Alternative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation

Institutional controls for the DRMO Yard source area would include land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately eight wells (six existing and two new wells) for 30 years. Land use restrictions include limiting future use of the land to operations currently conducted at the DRMO Yard. Access restrictions include maintaining the existing fence around the DRMO Yard. Additional institutional controls would include a prohibition on refilling the DRMO Yard fire suppression tank from the existing potable water supply well until state and federal MCLs are met (except

in emergency situations). This restriction would effectively limit significant groundwater pumping from the aquifer, which could affect the existing groundwater contaminant plume.

The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection, dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed periodically to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation will be conducted using six existing wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two groundwater monitoring wells when required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including the contaminants that were found to exceed the state and federal MCLs or their potential degradation products as specified in the RAOs for the DRMO Yard source area. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined specifically during the Remedial Design phase. Changes to this remedy may be required as a result of the Remedial Design or construction phase. These changes will be addressed in the post-ROD documents.

The estimated present worth cost of this alternative is \$180,000, which includes \$34,000 for capital costs and \$146,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

5.4.1.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation

This alternative involves treatment of VOC-contaminated soils in place via SVE, on-site treatment of groundwater via AS with natural attenuation, and groundwater monitoring/evaluation.

The SVE/AS system will inject air below the groundwater table to promote movement of VOCs from subsurface soils and groundwater and to collect the vapors by applying a vacuum through a series of vapor extraction wells. The SVE/AS system would be installed to provide active treatment out to the 20-ppb isocontour of the defined groundwater plume (see Figure 5-1). Treatment beyond this isocontour out to the state and federal MCL of 5 ppb would be through natural attenuation, except for a line of curtain wells near Channel B to prevent contaminants from entering the surface water.

For cost analysis purposes, the major components of the enhanced SVE system are assumed to include approximately 21 driven-point extraction wells; below-ground, horizontal polyvinyl chloride (PVC) piping, valves, sampling ports, and vacuum gauges; 10 extraction blowers; an air/water separator with storage tank; and a heating system for the prefabricated buildings and SVE piping. The blowers would be housed in prefabricated buildings. The SVE system would consist of explosion-proof equipment and automatic safety devices that would deactivate the system if the treatment building interior atmosphere were to exceed 20% of the lower explosive limit. Treatment of exhaust gases will be accomplished by directing these gases through a granulated activated carbon filter unit or air mixing chamber if sampling results exceed regulatory limits. Any water extracted from the air/water separator would be collected in a drum or tank, treated via carbon filtration, and discharged to the sanitary sewer system. The major components of the AS system would include 62 driven-point sparging wells; below-grade, horizontal PVC piping; and 10 centrifugal injection blowers. Changes to this remedy may be required as a result of the Remedial Design phase. These changes will be addressed in post-ROD documents.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone, where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gas treatment will occur until it is determined that off-gases are safe. The SVE discharge will be monitored during initial operations to determine whether filtration or dispersion of off-gases is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to the state and federal MCLs within several months to two years, dependent on many conditions

including initial contaminant concentrations. Because of climatic conditions at Fort Wainwright, it is estimated that SVE/AS treatment would operate for three years to meet state and federal MCLs in the active treatment zone and 10 years in the remainder of the groundwater plume, which is located beyond the 20-ppb isocontour.

Remediation of VOC-contaminated soil and groundwater at the DRMO Yard source area by natural attenuation is expected to take more than 50 years.

The estimated present worth cost of this alternative would be approximately \$2,195,000, which comprises \$1,426,000 for capital costs, \$680,000 for annual O&M costs, and \$89,000 for annual groundwater monitoring. For costing purposes, it was assumed that a groundwater monitoring program would be implemented and that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.1.4 Alternative 4: Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

This alternative supplements the remedial measures included under Alternative 3. One thousand nine hundred cubic yards of benzo(a)pyrene-contaminated surface soils would be excavated from the DRMO Yard and transported to the Fort Wainwright Landfill. Clean fill would replace the excavated material. Excavation and disposal of benzo(a)pyrene-contaminated soil would require one month. See DRMO Yard Alternative 3 above for a description of SVE/AS and groundwater monitoring. Soil contaminated with benzo(a)pyrene does not contribute to groundwater contamination and falls within the acceptable risk range for human health.

The estimated present worth cost of this alternative would be approximately \$2,269,000, which comprises \$1,498,000 for capital costs, \$682,000 for annual O&M costs, and \$89,000 for annual groundwater monitoring. For costing purposes, it was assumed that there would be one monitoring event per year (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.1.5 Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Benzo(a)pyrene-Contaminated Soils

On-site solidification involves encapsulating benzo(a)pyrene-contaminated soils in concrete. Benzo(a)pyrene-contaminated soil will be excavated, solidified using a Portland cement matrix slurry, and disposed of on site. Excavation and solidification of benzo(a)pyrene-contaminated soils would require three months. See DRMO Yard Alternative 3 above for a description of an SVE/AS system and groundwater monitoring.

The estimated present worth cost of this alternative would be approximately \$2,892,000, which comprises \$2,062,000 for capital costs, \$698,000 for annual O&M costs, and \$132,000 for annual groundwater monitoring. For costing purposes, one monitoring event per year was assumed (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). The estimated time frame for cleanup goals to be achieved and for monitoring to be performed is 15 years. These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2 Building 1168 Leach Well

Preliminary remedial alternatives for the Building 1168 Leach Well source area are described below. Numerous assumptions had to be made to determine cleanup time frames. These include consistent contaminant concentrations in soil and groundwater, treatment efficiencies similar to the currently operating SVE/AS system, and consistent groundwater flow.

5.4.2.1 Alternative 1: No Action

The no-action alternative for the Building 1168 Leach Well source area involves no environmental monitoring, institutional controls, or remedial action and would leave the VOC-contaminated soil and groundwater and petroleum-contaminated soils in their present state. Operation of the existing pilot-scale treatability system would be discontinued. The contaminated soils will continue to be subjected to infiltration and vertical seepage, which would cause further contamination of the groundwater. The groundwater plume will continue to migrate in the direction of groundwater flow. Development of the no-action alternative is required by the NCP to provide a basis of comparison for the remaining alternatives, serving as a baseline reflecting current conditions without any cleanup effort. The no-action alternative was evaluated consistent with NCP requirements. No present worth capital, O&M, or groundwater monitoring costs are associated with this no-action alternative.

5.4.2.2 Alternative 2: Institutional Controls and Natural Attenuation

Institutional controls for the Building 1168 Leach Well source area will include well installation restrictions, land use and site access restrictions, and downgradient groundwater monitoring/evaluation that includes developing and implementing a long-term annual groundwater monitoring program for approximately four wells (two existing and two new wells) for 30 years. Operation of the existing pilot-scale treatability study system would be discontinued. Land use restrictions include limiting future use of the land to operations being conducted at the Building 1168 Leach Well. The VOC-contaminated groundwater would remain as it exists at this source area, thereby not reducing contaminant concentrations other than through natural attenuation. However, institutional controls would decrease or minimize human exposure to contaminants. Periodic inspections and maintenance of the institutional controls would be conducted. Groundwater use restrictions would be incorporated into the Fort Wainwright Comprehensive Master Plan.

Natural attenuation or breakdown of contaminants occurs over time and is the reduction of contaminant concentrations in the environment through biological processes (aerobic and anaerobic biodegradation, and plant and animal uptake), physical phenomena (advection,

dispersion, dilution, diffusion, volatilization, and sorption/desorption), and chemical reactions (ion exchange, complexation, and abiotic transformation). Remediation of VOC-contaminated soil and groundwater at the Building 1168 Leach Well source area by natural attenuation is expected to take more than 50 years.

Environmental monitoring and data evaluation would be performed to obtain information regarding the effectiveness of the natural attenuation process in remediating the contamination, as well as to track the extent of contaminant migration from the site. To the extent practicable, this monitoring and evaluation would be conducted using four wells that are screened in geological zones hydraulically connected with the contamination source, supplemented by installing two additional groundwater monitoring wells if required. Upgradient wells would be used to provide information about the background groundwater quality at a source. Downgradient wells are used to monitor the extent of contaminant migration, change in flow direction, or occurrence of degradation products to protect downgradient drinking water wells.

Monitoring requirements would target VOCs, including contaminants that were found to exceed the state and federal MCLs or their potential degradation products, as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. The frequency of monitoring would be defined during the post-ROD activities.

The estimated present worth cost of this alternative is \$130,000, which comprises \$49,000 for capital costs and \$81,000 for annual groundwater monitoring, based on an estimated 30-year time frame for groundwater monitoring for cost estimating purposes (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation and flow direction). However, monitoring would occur until state and federal MCLs are achieved, which would be more than 30 years.

These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.3 Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, and Monitoring

A pilot-scale treatability system is operating at the source area to test the effectiveness of the technologies included in this alternative. This alternative would upgrade the existing system to a full-scale system. The saturated zone active treatment area would be expanded by a factor of six to cover the entire contaminated saturated zone. System modifications would include installation of approximately four additional sparge points and one additional SVE point, increasing the capacity of sparging, extraction, and control equipment. System modification also would require installation of an additional blower to compensate for the increased head losses of the additional wells and piping.

Air will be injected below the water table to strip volatiles from groundwater and soil in the saturated and unsaturated zones, respectively. Volatiles are purged to the unsaturated zone,

where they will be collected in the vacuum extraction wells. In addition, the vacuum extraction wells create a negative pressure in the unsaturated soil, which enhances contaminant mobility. From the extraction wellhead, the VOCs are routed to the treatment facility. Under current regulations, no off-gas treatment is required. However, off-gases were treated initially through a carbon adsorption system. Use of the treatment system was discontinued because air modeling using a worst-case scenario indicated that treatment was unnecessary. This system can be restarted if analytical results indicate that off-gas treatment is necessary.

Regular monitoring of the enhanced SVE system will be conducted to ensure and document its effectiveness and optimize the progress of cleanup. Vapor samples and airflow readings taken from the soil vapor monitoring probes and system exhaust sampling ports will be utilized to monitor the progress of cleanup, to estimate the volume of VOCs removed by the system, and to establish a timetable and cost estimate for completion of the project.

Historically, SVE/AS remediation has been successful at remediating soil and groundwater to state and federal MCLs within several months to two years, depending on many conditions including initial contaminant concentrations. Based on the operational data acquired since the start of the pilot-scale treatment system in 1994, it is estimated that SVE/AS treatment would operate an additional three years to meet state and federal MCLs in the active treatment zone. State and federal MCL exceedances outside the active treatment zone are anticipated to attenuate naturally, partially in response to the increased downgradient dissolved oxygen availability associated with the active treatment system.

Monitoring requirements will target the contaminants that were found to exceed the state and federal MCLs as specified in the RAOs for the Building 1168 Leach Well source area. Sample collection, analysis, and data evaluation would continue until sufficient data regarding changes in contaminant plume migration (including potential seasonal fluctuations in groundwater contaminant concentrations) and attenuation rates are gathered. To the extent practicable, monitoring data requirements will be coordinated or combined with those from other state or federal programs, such as RCRA and the Safe Drinking Water Act. The frequency of monitoring would be defined specifically in post-ROD documents.

This alternative would achieve remediation goals in approximately three years. Groundwater monitoring would be conducted 10 years. For costing purposes, one well would be installed for the SVE system and four wells would be installed for the AS system for an operational period of three years. The estimated present worth cost of this alternative would be approximately \$269,000, which comprises \$174,000 for capital, \$66,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.4 Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that approximately 1,400 cubic yards of soil contaminated with DRO; GRO; and benzene, toluene, ethylbenzene, and total xylenes will be excavated and treated using a low-temperature thermal desorption (LTTD) process. This

alternative would be implemented only if SVE/AS could not reduce contaminant concentrations in the unsaturated zone to below RAOs. LTTD involves heating excavated soils in a rotary kiln dryer to release organic contaminants and moisture in the form of gases. The gases go through a series of cooling and condensing stages before they are vented.

Excavation would be conducted to an estimated depth of 19 feet below present grade, which would require shoring. Approximately 4,400 cubic yards of uncontaminated overburden material would need to be removed. Clean soil would replace the 1,300 cubic yards of excavated soil. The treated soil would be disposed of at the Fort Wainwright Landfill.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring.

Excavation and LTTD treatment would require one month. The estimated present worth cost of this alternative would be approximately \$559,000, which comprises \$452,000 for capital, \$78,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

5.4.2.5 Alternative 5: Alternative 3 Plus Excavation and Engineered Pile Treatment (Biopile and Vapor Extraction Pile) of Contaminated Unsaturated Soil

This alternative is similar to Alternative 3, except that excavated soil is treated using engineered pile treatment at a nearby location. There are two options for the engineered pile treatment of the contaminated unsaturated soil: a vapor extraction pile and a biopile. Both options are ex situ remedies and would require excavation, as described in Building 1168 Leach Well Alternative 4. A vapor extraction pile uses the same processes as in situ vapor extraction, but the processes are applied to a pile in a lined cell. Blowers built into a piping system inject and extract air to strip off VOCs and petroleum hydrocarbons from the soil. Biopile or biocell treatment is a process that uses naturally occurring bacteria in soil to break down VOCs and petroleum hydrocarbons. The excavated soil is placed in lined piles and is aerated using an air injection system.

See Alternative 3 above for descriptions of SVE and groundwater AS and for a description of groundwater monitoring and evaluation requirements.

The estimated time frame for cleanup goals to be achieved is three years. The estimated present worth cost of this alternative would be \$498,000, which comprises \$350,000 for capital costs, \$119,000 for annual O&M costs, and \$29,000 for annual groundwater monitoring (monitoring may be more frequent during the initial post-ROD years to address seasonal changes in groundwater elevation, flow direction, and treatment system efficiency). These are estimated costs. Actual costs are likely to be within +50% to -30% of these cost values.

Table 5-1

SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS
The following contaminants were of concern for remedial evaluation	found in soils and were discarded or carried through the FS as contaminants n. This is based on the following reasons:
Soil	
Benzo(a)pyrene	Retain: Concentrations are within the 10 ⁻⁴ to 10 ⁻⁶ risk range. Benzo(a)pyrene was found in surface soils and is not considered a threat to groundwater.
PCBs	Discard: The maximum concentration of PCBs detected in soil at the DRMO Yard source area is 1.3 mg/kg, significantly less than the Toxic Substances Control Act (TSCA 1987) most restrictive cleanup level of 10 mg/kg.
Dioxin	Discard: Concentrations do not cause exceedance of 10 ⁻⁴ cancer risk for site worker, future site worker, future residents, future construction workers, and future recreational users/site visitors. In addition, dioxin is ubiquitous throughout the DRMO Yard source area, at very low concentrations. Analytical results do not indicate that a dioxin "hot spot" exists.
DRO	Discard: DRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.
GRO	Discard: GRO in the DRMO Yard soils is attributed to surface spills and UST releases and will be addressed in a separate Two-Party Agreement between the Army and ADEC.
Dieldrin	Discard: The HRA concluded that cancer risk presented by dieldrin exceeded 10 ⁻⁶ for two exposure pathways (current/future worker RME dermal contact with surface soil and future resident RME dermal contact with surface soil). However, resampling of surface soil in August 1995 in five locations around the only sampling location where dieldrin was previously detected indicates that dieldrin concentrations are not detectable or are two to three orders of magnitude below 1 mg/kg (1 mg/kg corresponds to a 10 ⁻⁴ cancer risk to future residents). Dieldrin was detected in six of 314 samples.
Arsenic	Discard: Concentrations cause exceedance of 10 ⁻⁶ cancer risk for two exposure pathways (current/future worker RME and future resident RME and average exposure ingestion of surface soil) but was not considered a COC because of documented elevated concentrations of arsenic in background surface soil samples. Recalculation of risks after subtracting background concentrations results in a cancer risk of less than 10 ⁻⁶ .

Table 5-1

SELECTION OF CHEMICALS OF CONCERN FOR REMEDIAL EVALUATION IN THE FEASIBILITY STUDY FOR DRMO YARD OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern to the FS	Basis for Discarding or Retaining as Chemical of Concern to the FS	
The following contaminants were found in groundwater and were discarded or carried through the FS as contaminants of concern for remedial evaluation. This is based on the following reasons:		
Groundwater		
Benzene	Retain: Concentrations cause exceedance of MCL.	
Trichloroethene	Retain: Concentrations measured in excess of MCL.	
Tetrachloroethene	Retain: Concentrations cause exceedance of MCL.	
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations results in a hazard index of less than 1.0 for the entire DRMO Yard.	
Chloroform	Discard: Concentrations cause slight exceedance of 10 ⁻⁶ cancer risk for one exposure pathway (future resident RME inhalation) but was not considered a COC because concentrations did not exceed MCL.	
Dioxin	Discard: Concentrations cause exceedance of 10 ⁻⁶ cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.	
1,4-Dichlorobenzene	Discard: Concentrations cause exceedance of 10 ⁻⁶ cancer risk for one exposure pathway (future resident RME ingestion) but was not considered a COC because concentrations did not exceed MCL.	

Note: Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key:

- ADEC = Alaska Department of Environmental Conservation.
- Army = United States Army.
- COC = Chemical of concern.
- DRMO = Defense Reutilization and Marketing Office.
- DRO = Diesel-range organics.
 - FS = Feasibility Study.
- GRO = Gasoline-range organics.
- HRA = Human Health Risk Assessment.
- MCL = Maximum contaminant level.
- mg/kg = Milligrams per kilogram.
- PCBs = Polychlorinated biphenyls.
- RME = Reasonable maximum exposure.
- TSCA = Toxic Substances Control Act.
- UST = Underground storage tank.

Table 5-2

SELECTION OF CHEMICALS OF CONCERN TO THE FEASIBILITY STUDY FOR BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Chemicals of Potential Concern	Discard or Retain as Chemical of Concern to the FS and Bases	
Soil		
DRO	Retain: Concentrations exceed ADEC guidelines.	
GRO	Retain: Concentrations exceed ADEC guidelines.	
втех	Retain: Concentrations exceed ADEC guidelines.	
Groundwater		
Benzene	Retain: Concentrations cause exceedance of MCL.	
Trichloroethene	Retain: Concentrations cause exceedance of MCL.	
Manganese	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion) but was not considered a COC because of documented elevated concentrations of manganese in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0.	
Arsenic	Discard: Concentrations cause exceedance of hazard index of 1.0 for one exposure pathway (future resident RME and average ingestion). Arsenic concentrations also cause exceedance of 10 ⁻⁶ cancer risk for one exposure pathway (future resident RME and average ingestion). However, arsenic is not considered a COC because of documented elevated concentrations of arsenic in background groundwater samples. Recalculation of risks after subtracting background concentrations of manganese and arsenic results in a hazard index of less than 1.0. Background arsenic concentrations still contribute to cancer risk in excess of 10 ⁻⁶ .	

Note:

Breakdown products of the contaminants of concern were not in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

Key:

ADEC = Alaska Department of Environmental Conservation.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

COC = Chemical of concern.

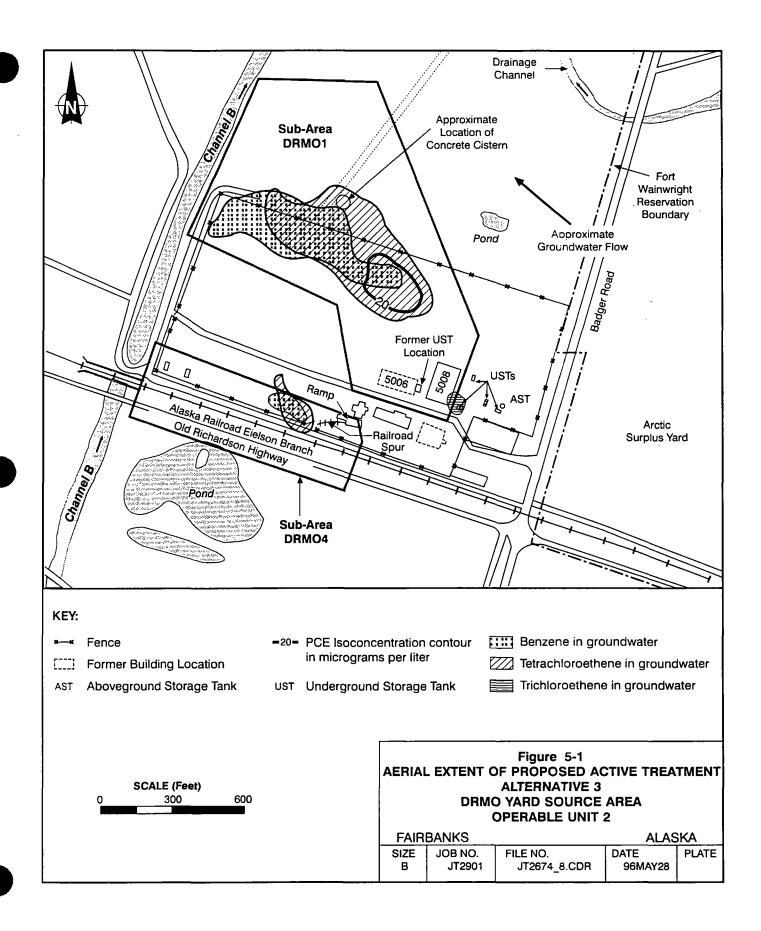
DRO = Diesel-range organics.

FS = Feasibility Study.

GRO = Gasoline-range organics.

MCL = Maximum contaminant level.

RME = Reasonable maximum exposure.



6.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In accordance with federal regulations, the five alternatives for the DRMO Yard source area and five other alternatives for the Building 1168 Leach Well source area were evaluated based on the nine criteria presented in the NCP.

6.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD SOURCE AREA (COMPARATIVE ANALYSIS OF ALTERNATIVES)

6.1.1 Threshold Criteria

6.1.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would rely on natural processes to slowly decrease contaminant concentrations in the soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

6.1.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active soil and groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under all of the alternatives.

6.1.2 Main Balancing Criteria

6.1.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the benzo(a)pyrene-contaminated soil. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

6.1.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that reduce the toxicity and mobility of VOC-contaminated soil and groundwater. Alternative 4 would slightly increase the volume of contaminated soil and would not decrease toxicity or mobility of benzo(a)pyrene. Alternative 5 would reduce the mobility and significantly increase the volume of contaminated material. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

6.1.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to 10 years to achieve state and federal MCLs. The excavation and disposal in Alternative 4 would require one month. Solidification (Alternative 5) would require approximately three months.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame to reach remedial goals will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil contamination, it is expected that groundwater contaminant levels would be reduced during the estimated three-year cleanup period. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time, except through natural attenuation.

6.1.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. Alternatives 1 and 2 would be readily implementable because they would require no additional action other than monitoring or institutional controls. A pilot-scale test study or field test would be conducted before full-scale implementation of the SVE and AS systems proposed in Alternatives 3, 4, and 5. A solidification treatability study would be required before implementing Alternative 5.

6.1.2.5 Cost

The estimated present worth cost for each alternative evaluated for the DRMO Yard source area is shown in Table 6-1. Detailed baseline cost estimates are included in Appendix D.

Based on the information available at the time the alternatives were developed, the estimated costs for each alternative evaluated for the DRMO source area are in Table 6-1. Actual costs are likely to be within +50% to -30% of the values on the table. Present worth is based on a 5% discount rate over 30 years.

6.1.3 Modifying Criteria

6.1.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees

with the selected alternative for the DRMO Yard source area.

6.1.3.2 Community Acceptance

Although no official comments were received, community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

6.2 BUILDING 1168 LEACH WELL (COMPARATIVE ANALYSIS OF ALTERNATIVES)

6.2.1 Threshold Criteria

6.2.1.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4, and 5 would provide the greatest protection to human health and the environment by actively treating contaminated soil and groundwater. Alternatives 1 and 2 would provide no treatment and would not be protective of human health or the environment.

6.2.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, 4, and 5 are expected to achieve regulatory requirements. Alternatives 3, 4, and 5 include active groundwater treatment to achieve state and federal MCLs and would be expected to achieve these standards more rapidly than Alternative 2. Alternative 2 would rely on natural processes that slowly decrease soil and groundwater contamination. Alternative 1 would not comply with ARARs. AWQS would be achieved through natural attenuation under Alternatives 3, 4, and 5.

6.2.2 Balancing Criteria

6.2.2.1 Long-Term Effectiveness and Permanence

Alternatives 3, 4, and 5 would involve permanent and active reduction of soil and groundwater contamination and would achieve long-term effectiveness. Alternatives 4 and 5 would permanently remove the VOC-contaminated soil by excavation and treatment. None of the contaminants would be addressed by Alternatives 1 and 2, except through natural processes. Therefore, Alternatives 1 and 2 would provide the least effective long-term permanence.

6.2.2.2 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternatives 3, 4, and 5 would involve treatment technologies that would reduce the toxicity and mobility of contaminants in soil and groundwater. Alternatives 4 and 5 would reduce the volume of the contaminated soil by excavation and treatment. Alternatives 1 and 2 would not reduce the toxicity, mobility, or volume of the contaminants through treatment.

6.2.2.3 Short-Term Effectiveness

Alternatives 3, 4, and 5 would pose some short-term potential risks to on-site workers during the estimated three months for groundwater treatment installation and soil excavation (Alternatives 4 and 5). These risks could be minimized by engineering controls. These alternatives may take up to three years to achieve groundwater cleanup to state and federal MCLs. The excavation and LTTD portion of Alternative 4 would be expected to require one field season. The engineered pile treatment portion of Alternative 5 would require five years.

Risks associated with groundwater contamination are equal for Alternatives 3, 4, and 5. Because Alternatives 3, 4, and 5 actively treat soil and groundwater contamination, it is expected that contaminant levels would be reduced during the estimated three-year cleanup period. Under Alternative 1, no monitoring would be conducted to determine the groundwater remediation time frame. However, it is expected that the time frame for remediation will be similar to Alternative 2—natural attenuation with groundwater monitoring—which is estimated to exceed 50 years. Alternatives 1 and 2 do not actively treat soil contamination; therefore, risks would not change over time except through natural attenuation.

6.2.2.4 Implementability

All alternatives would use readily available technologies and would be feasible to construct. The SVE and AS system pilot study is being conducted at the Building 1168 Leach Well, and results to date indicate that the system is effectively remediating the groundwater contamination. Alternatives 3, 4, and 5 propose expansion of this system for full-scale treatment. LTTD and engineered pile treatability studies would be required before implementing Alternatives 4 and 5, respectively.

6.2.2.5 Cost

The estimated present worth cost for each alternative evaluated for the Building 1168 Leach Well source area is shown in Table 6-2. Detailed cost tables are in Appendix D.

6.2.3 Modifying Criteria

6.2.3.1 State Acceptance

ADEC has been involved with the development of remedial alternatives for OU-2 and agrees with the selected alternative for the Building 1168 Leach Well source area.

6.2.3.2 Community Acceptance

Although no official comments were received, the community response to the preferred alternatives was generally positive. Community response to the remedial alternatives is presented in the Responsiveness Summary, which addresses comments received during the public comment period.

Table 6-1

PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	\$0	\$0	\$0	\$0	\$0
Alternative 2: Institutional Controls, Natural Attenuation, and Groundwater Monitoring/Evaluation	\$34,000	\$0	\$146,000	\$180,000	\$146,000
Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging, Natural Attenuation, and Groundwater Monitoring/Evaluation	\$1,426,000	\$680,000	\$89,000	\$2,195,000	\$769,000
Alternative 4: Alternative 3 Plus Excavation and Disposal of Surface Soils Containing Benzo(a)pyrene	\$1,498,000	\$682,000	\$89,000	\$2,269,000	\$771,000
Alternative 5: Alternative 3 Plus Excavation and On-Site Solidification of Soils Containing Benzo(a)pyrene	\$2,062,000	\$698,000	\$132,000	\$2,892,000	\$830,000

Kcy:

DRMO = Defense Reutilization and Marketing Office.

Table 6-2

PRESENT WORTH COSTS FOR REMEDIAL ALTERNATIVES BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Description	Capital Cost	Annual Operation and Maintenance Cost	Annual Groundwater Monitoring Cost	Total Present Worth Cost	Present Worth of Annual Cost
Alternative 1: No Action	\$0	\$0	\$0	\$0	\$0
Alternative 2: Institutional Controls and Natural Attenuation with Groundwater Monitoring/Evaluation	\$49,000	\$0	\$81,000	\$130,000	\$81,000
Alternative 3: Soil Vapor Extraction, Groundwater Air Sparging with Natural Attenuation, and Groundwater Monitoring/Evaluation	\$174,000	\$66,000	\$29,000	\$269,000	\$95,000
Alternative 4: Alternative 3 Plus Excavation and Low-Temperature Thermal Desorption of Unsaturated Soil	\$452,000	\$78,000	\$29,000	\$559,000	\$107,000
Alternative 5: Alternative 3 Plus Engineered Pile Treatment of Unsaturated Soil	\$350,000	\$119,000	\$29,000	\$498,000	\$148,000

7.0 SELECTED REMEDIES

7.1 DEFENSE REUTILIZATION AND MARKETING OFFICE YARD

Because it best meets the nine CERCLA criteria, Alternative 3 is the selected remedy for groundwater contamination for the DRMO Yard source area. This alternative involves inplace treatment of soils via vacuum extraction; in-place, on-site treatment of groundwater via air sparging; groundwater monitoring/evaluation; and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs through active treatment of soil and groundwater (see Table 7-1). This alternative protects the on-site potable drinking water well as well as the downgradient drinking water aquifer by treating and controlling the source of contamination and is viewed as being an effective and permanent solution to contamination at the DRMO Yard.

After a thorough assessment of the applicable alternatives for the DRMO Yard source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. After evaluation of the potential risks and appropriate cleanup standards and comparison with the nine CERCLA criteria, it was determined that action is not required for benzo(a)pyrene in soils. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

7.1.1 Major Components of the Selected Remedy

- In situ treatment of groundwater and soil via air sparging to attain state and federal drinking water standards. Air sparging wells will be placed in the areas of highest contamination;
- In situ treatment of soils via soil vapor extraction to prevent contaminated unsaturated soils from acting as an ongoing source of contamination to groundwater. Soil vapor extraction wells will be placed in areas of highest soil contamination;
- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;
- •- The treatment system will be evaluated and modified as necessary to optimize effectiveness;
- Duration of treatment system operation is estimated to be three years in the active treatment zone and nine years at the Channel B wells to meet soil cleanup goals and state and federal maximum contaminant levels.
 A combination of groundwater monitoring and off-gas measurements will be used to determine attainment of remedial action objectives;

- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards;
- Maintaining institutional controls, including restricted access and well
 development restrictions, and a groundwater monitoring and evaluation
 program for the potable drinking water supply wells. These controls
 will remain in place as long as hazardous substances remain on site at
 levels that preclude unrestricted use; and
- Additional institutional controls to prohibit refilling the DRMO Yard fire suppression water tank from the existing DRMO Yard potable water supply well until state and federal maximum contaminant levels are met (except in emergency situations).

7.1.2 Goals of Remedial Action

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal regulations for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

7.1.2.1 Defense Reutilization and Marketing Office Yard Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L) ^a
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

Groundwater remediation goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 Code of Federal Regulations [CFR] 141.147 and 18 AAC 80).

At the DRMO Yard, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils (see Table 7-2).

The cost for Alternative 3 is \$1,498,000 for present worth capital costs, which include direct and indirect cost; annual monitoring for 15 years (monitoring frequency may vary) at \$89,000; and present worth of annual operating cost \$680,000, for a total cost of \$2,195,000.

The remedial action goal for in situ soils contaminated with comingled VOC- and petroleum related-compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is a drinking water aquifer. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

7.2 BUILDING 1168 LEACH WELL

Alternative 3 is the preferred alternative for the Building 1168 Leach Well source area because it best meets the nine CERCLA criteria summarized in Table 7-3. This alternative involves in place treatment of soils and groundwater via soil vapor extraction/air sparging, groundwater monitoring, and institutional controls. Alternative 3 is expected to achieve overall protection of human health and the environment and to meet ARARs (see Table 7-4). In addition, this alternative is viewed as being an effective and permanent solution to contamination at the Building 1168 Leach Well.

After a thorough assessment of the applicable alternatives for the Building 1168 Leach Well source area, taking groundwater risks, cleanup times, and cost into consideration, it was determined that protection of human health and the environment is best attained through active in-place treatment of soils and groundwater. This alternative is believed to provide the best balance of criteria among the alternatives evaluated.

7.2.1 Major Components of the Selected Remedy

- In situ treatment of groundwater via air sparging to remove volatile organic compounds, thereby attaining state and federal drinking water standards. Additional air sparging wells will be placed to optimize the existing treatment system;
- In situ treatment of soils via soil vapor extraction to prevent contaminated soils from acting as an ongoing source of contamination to

groundwater. Additional soil vapor extraction wells will be placed to optimize the existing treatment system;

- The treatment system will be evaluated and modified as necessary to optimize effectiveness;
- Air emissions from the soil vapor extraction/air sparging treatment system will be monitored and evaluated periodically to meet emission requirements;
- The duration of treatment system operation is estimated to be three
 years to meet State of Alaska cleanup levels for non-underground
 storage tank petroleum-contaminated soil and state and federal MCLs.
 A combination of groundwater monitoring and off-gas measurements
 will be used to determine attainment of remedial action objectives;
- After active treatment achieves state and federal maximum contaminant levels, natural attenuation will be relied on to achieve Alaska Water Quality Standards; and
- Maintaining institutional controls, including restricted access and well development restrictions, as long as hazardous substances remain on site at levels that preclude unrestricted use.

7.2.2 Goals of Remedial Action

The overall goal of a remedial action is to provide the most effective mechanism to meet state and federal MCLs for drinking water. To facilitate selection of the most appropriate remedial action, source area-specific cleanup objectives that specify the contaminants of concern in each medium of interest, exposure pathways and receptors, and an acceptable regulatory level were developed. The following remediation goals were established for the specific contaminants of concern determined to require remedial action at both source areas. These goals are intended for the areas where active remediation will occur.

7.2.3 Building 1168 Leach Well Groundwater and Soil

CHEMICALS OF CONCERN IN GROUNDWATER	REMEDIATION GOAL (μg/L) ^a
Benzene	5.0
Trichloroethene	5.0
Tetrachloroethene	5.0
Vinyl chloride	2.0
1,1-Dichloroethene	7.0
1,2-Dichloroethene	70.0

Groundwater remediation goals are based on state and federal MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

At the Building 1168 Leach Well, after state and federal MCLs are achieved through active remediation, passive treatment of groundwater through natural attenuation will be relied on to attain cleanup levels mandated by the AWQS (18 AAC 70).

Because soils contaminated with VOCs and petroleum-related compounds are acting as a continuing source of contamination to groundwater, the remedial action goal for in situ soils is active remediation until contaminant levels in groundwater are consistently below state and federal MCLs. The State of Alaska cleanup levels for non-UST petroleum-contaminated soil will be considered as a guideline for the treatment of in situ soils.

The cost for Alternative 3 is \$174,000 for present worth capital costs, which include direct and indirect costs; annual monitoring for 15 years at \$29,000 (monitoring frequency may vary); and a present worth of annual operating cost of \$66,000, for a total cost of \$269,000.

The remedial action goal for in situ soils contaminated with VOC and POL compounds is protection of the groundwater. Because the soils are acting as a continuing source of contamination to the groundwater, active remediation of the soils will continue until state and federal MCLs are met consistently. Natural attenuation will continue until AWQS are met. Some changes or modifications could be made to the remedy as a result of Remedial Design and construction processes. These changes will be addressed in post-ROD documents.

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this site, a potential drinking water aquifer, and to remediate soil to State of Alaska cleanup levels for non-UST petroleum-contaminated soil. Based on information obtained during the RI and on careful analysis of all remedial alternatives, the Army, EPA, and ADEC believe that the selected remedy would achieve this goal.

Because the remedies will result in contaminants remaining on site above health-based or regulatory levels, a review will be conducted within five years after commencement of remedial action. This review will ensure that the remedies continue to provide adequate protection of human health and the environment.

DRMO YARD REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Remedial Action Objectives	Chemicals of Concern	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Environmental Protection	DRO	ADEC Cleanup Matrix ^a	ADEC 18 AAC 78	2,500 mg/kg
Prevent migration of chemicals of concern that could result in	Benzene	5 μg/L	MCL	7.50 g/L
groundwater contamination exceeding chemical-specific ARARS. Restore groundwater to below chemical-specific ARARs.	Tetrachloroethene	5 μg/L	MCL	190 μg/L
Human Heath	Trichloroethene	5 μg/L	MCL	17 μg/L
	Vinyl chloride	2 μg/L	Potential degradation	ND
Reduce cancer risk (via ingestion and inhalation by future residents) to within or below the 1×10^{-4} to 1×10^{-6} risk	1,1-DCE ^b	7 μg/L	Potential degradation	ND
range.	1,2-DCE ^b	70 μg/L	Potential degradation	ND

ADEC soil matrix concentrations will be considered as a guidance for in situ treatment of soils.

Key:

AAC = Alaska Administrative Code.

ADEC = Alaska Department of Environmental Conservation.

ARARs = Applicable or relevant and appropriate requirements.

DCE = Dichloroethene.

DRMO = Defense Reutilization and Marketing Office.

DRO = Diesel-range organics.

g/L = Grams per liter.

MCL = Maximum contaminant level.

mg/kg = Milligrams per kilogram. $\mu g/L = Micrograms per liter.$

ND = Not detected.

Breakdown products of trichloroethene were not detected at concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL DRMO YARD SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

CLEANUP GOALS FOR SOIL DRMO YARD SCORE ADEC Cleanup Level (mg/kg) Diesel Gasoline/Unknown Matrix Score = 44 BTEX = 15 mg/kgDiesel-Range Gasoline-Range Benzene = 0.5 mg/kgPetroleum Petroleum VPH = 100 mg/kgHydrocarbons Hydrocarbons EPH = 200 mg/kg(VPH) BTEX (EPH) Benzene Level Ae >40 50 0.1 10 100

200

1,000

2,000

27 - 40

21 - 26

<20

100

500

1,000

0.5

0.5

0.5

15

50

100

Key:

Level B

Level C

Level D

AAC = Alaska Administrative Code.

ADEC = Alaska Department of Environmental Conservation.

BTEX = Benzene, toluene, ethylbenzene, xylene.

CFR = Code of Federal Regulations.

DRMO = Defense Reutilization and Marketing Office.

EPH = Diesel-range petroleum hydrocarbons.

MCLs = Maximum contaminant level.

 $\mu g/L$ = Micrograms per liter.

mg/kg = Milligram per kilogram.

USAED Alaska = United States Army Engineer District, Alaska.

VPH = Gasoline-range petroleum hydrocarbons.

^a Site-specific background groundwater concentration.

b Background concentrations from USAED Alaska-recommended background value for Fort Wainwright.

^C Groundwater remedial goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).

d 18 AAC 70, Water Quality Standards. The regulatory level for BTEX is 10 μ g/L.

e Level A cleanup goal is applied to the total matrix score of 44 because of the soil acting as an ongoing source of contamination to groundwater.

BUILDING 1168 LEACH WELL SOURCE AREA REMEDIAL ACTION OBJECTIVES AND REMEDIATION GOALS OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

Media	Remedial Action Objectives	Chemicals of Concern	Preliminary Remediation Goal	Basis	Maximum Measured Concentration
Subsurface soil	Subsurface soil Environmental Protection Prevent migration of chemicals of concern.	DRO	ADEC soil cleanup matrix ^a	ADEC 18 AAC 78	435 mg/kg
		GRO	ADEC soil cleanup matrix ^a	ADEC 18 AAC 78	2,000 mg/kg
	Reduce chemical concentrations to below ADEC cleanup levels.	втех	ADEC soil cleanup matrix ^a	ADEC 18 AAC 78	Not available
Groundwater	Groundwater Environmental Protection Restore groundwater to below chemical- specific ARARs.	Benzene	5 μg/L	MCL	250 μg/L ^b
		Trichloroethene	5 μg/L	MCL	23.0 g/L
Human Health Reduce cancer risk (via ingestion and inhalation by future residents) to within or below the EPA accepted risk range of 1×10^{-4} to 1×10^{-6} .	Vinyl chloride	2 μg/L	Potential degradation product	ND	
	or below the EPA accepted risk range of	1,1-DCE	7 μg/L	Potential degradation product	ND
		1,2-DCE	70 μg/L	Potential degradation product	ND

Note: Breakdown products of trichloroethene were not detected in concentrations that exceeded action levels; however, these will be included in groundwater monitoring.

ADEC soil concentrations will be considered as a guidance for treatment of in situ soils.

Maximum concentration of benzene was measured in a groundwater sample collected from Microwell installed by Pine and Swallow under direction from the United States Army's Cold Regions Research and Engineering Laboratory. The sample was collected and analyzed in September 1993 (HLA 1994).

Table 7-3 (Cont.)

Key:

AAC = Alaska Administrative Code.

ADEC = Alaska Department of Environmental Conservation.

ARARs = Applicable or relevant and appropriate requirements.

BTEX = Benzene, toluene, ethylbenzene, and total xylenes.

DCE = Dichloroethene.

DRO = Diesel-range organics.

EPA = United States Environmental Protection Agency.

GRO = Gasoline-range organics.

g/L = Grams per liter.

HLA = Harding Lawson Associates.

MCL = Maximum contaminant level.

 μ g/L = Micrograms per liter.

mg/kg = Milligrams per kilogram.

ND = Not detected.

CHEMICAL-SPECIFIC CLEANUP GOALS FOR SOIL BUILDING 1168 LEACH WELL SOURCE AREA OPERABLE UNIT 2 FORT WAINWRIGHT, ALASKA

CLEANUP GOALS FOR SOIL BUILDING 1168 LEACH WELL SOURCE AREA SCORE ADEC Cleanup Level (mg/kg) Diesel Gasoline/Unknown Matrix Score = 46 BTEX = 15 mg/kgDiesel-Range Gasoline-Range Benzene = 0.5 mg/kgPetroleum Petroleum VPH = 100 mg/kgHydrocarbons Hydrocarbons EPH = 200 mg/kg(EPH) (VPH) BTEX Benzene Level A^e >40 100 50 0.1 10 Level B 27 - 40 200 100 0.5 15 50 Level C 21 - 26 1,000 500 0.5 100 < 20 2,000 1,000 Level D

- a Site-specific background groundwater concentration.
- Background concentrations from USAED Alaska-recommended background value for Fort Wainwright.
- Groundwater remedial goals are based on federal and state MCLs for organic contaminants in public water supply systems (40 CFR 141.147 and 18 AAC 80).
- d 18 AAC 70, Water Quality Standards. The regulatory level for BTEX is $10 \mu g/L$.
- e Level A cleanup goal is applied to the total matrix score of 46 because of soil acting as an ongoing source of contamination to groundwater.

Key:

AAC = Alaska Administrative Code.

ADEC = Alaska Department of Environmental Conservation.

BTEX = Benzene, toluene, ethylbenzene, total xylene.

CFR = Code of Federal Regulations.

EPH = Diesel-range petroleum hydrocarbons.

MCLs = Maximum contaminant level.

 $\mu g/L$ = Micrograms per liter.

mg/kg = Milligrams per kilogram.

USAED Alaska = United Stated Army Engineer District, Alaska.

VPH = Gasoline-range petroleum hydrocarbons.

8.0 STATUTORY DETERMINATIONS

The main responsibility of the Army, EPA, and ADEC under their legal CERCLA authority is to select remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA, as amended by SARA, provides several statutory requirements and preferences. The selected remedy must be cost-effective and utilize permanent treatment technologies or resource recovery technologies to the extent practicable. The statute also contains a preference for remedies that permanently or significantly reduce the volume, toxicity, or mobility of hazardous substances through treatment. CERCLA finally requires that the selected remedial action for each source area must comply with ARARs established under federal and state environmental laws, unless a waiver is granted.

8.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected alternatives for the DRMO Yard and Building 1168 Leach Well source areas will provide long-term protection of human health and the environment and satisfy the requirements of Section 121 of CERCLA.

8.1.1 Defense Reutilization and Marketing Office Yard

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

8.1.2 Building 1168 Leach Well

The selected remedy will provide long-term protection of human health and the environment by removing the contamination from soils and groundwater through installation of an SVE/AS system. The remedy will eliminate the potential exposure routes and minimize the possibility of contamination migrating to drinking water sources. Groundwater monitoring/evaluation will be completed to assess contaminant plume movement and concentrations.

8.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS AND TO-BE-CONSIDERED GUIDANCE

The selected remedy for each source area will comply with all applicable, relevant, and appropriate requirements of federal and state environmental and public health laws. These requirements include compliance with all the location-, chemical-, and action-specific ARARs listed below. No other waiver of any ARAR is being sought or invoked for any component of the selected remedies.

8.2.1 Applicable or Relevant and Appropriate Description

An ARAR may be either "applicable" or "relevant and appropriate." Applicable requirements are those substantive environmental protection standards, criteria, or limitations promulgated under federal or state law that specifically addresses a hazardous substance, remedial action,

location, or other circumstance at a CERCLA site. Relevant and appropriate requirements are those substantive environmental protection requirements promulgated under federal and state law that, while not legally applicable to the circumstances at a CERCLA site, addresses situations sufficiently similar to those encountered at the CERCLA site so that the requirements' use is well-suited to the particular site. The three types of ARARs are described below:

- Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies that establish an acceptable amount or concentration of a chemical in the ambient environment;
- Action-specific ARARs are usually technology- or activity-based requirements for remedial actions; and
- Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activity solely because the ARARs occur in special locations.

To-be-considered requirements (TBCs) are nonpromulgated federal or state standards or guidance documents that are to be used as appropriate in developing cleanup standards. Because they are not promulgated or enforceable, TBCs do not have the same status as ARARs and are not considered required cleanup standards. They generally fall into three categories:

- Health effects information with a high degree of credibility;
- Technical information regarding how to perform or evaluate site investigations or response actions; and
- State or federal agency policy documents.

8.2.2 Chemical-Specific Applicable or Relevant and Appropriate Requirements

- Federal Safe Drinking Water Act (40 CFR 141) and Alaska Drinking Water Regulations (18 AAC 80): The MCL and non-zero MCL goals were established under the Safe Drinking Water Act and are relevant and appropriate for groundwater that is a potential drinking water source;
- AWQS (18 AAC 70): Alaska Water Quality Standards for Protection of Class (1)(A) Water Supply, Class (1)(B) Water Recreation, and Class (1) Aquatic Life and Wildlife (18 AAC 70) are applicable to both source areas. Many of the constituents of groundwater regulated by AWQS are identical to MCLs in Drinking Water Standards;
- Alaska Oil Pollution Regulations (18 AAC 75): Alaska Oil Pollution Control Regulations, are applicable. Under these regulations, responsible parties are required to clean up oil or hazardous material

- releases. The Army anticipates achieving a cleanup level consistent with this regulation; and
- Alaska Regulations for Leaking Underground Storage Tanks (18 AAC 78): The State of Alaska has established cleanup requirements for petroleum-contaminated soils from leaking USTs to protect groundwater and are relevant and appropriate for the DRMO Yard.

8.2.3 Location-Specific Applicable or Relevant and Appropriate Requirements

No location-specific ARARs have been identified for the DRMO Yard and Building 1168 Leach Well source areas.

8.2.4 Action-Specific Applicable or Relevant and Appropriate Requirements

- RCRA Subtitle C Hazardous Waste Management Standards must be
 considered in the evaluation of whether any of the excavated soils from
 the OU-2 source areas exhibit the characteristics of a RCRA hazardous
 waste; however, no soils have been identified to date. RCRA
 regulations will be applicable to the storage and disposal of any RCRA
 hazardous waste;
- Federal Clean Air Act (42 United States Code 7401), as amended, is applicable for venting contaminated vapors;
- Alaska Air Quality Control Regulations (18 AAC 50). Although onsite remedial actions do not require permitting, the substance portion of these regulations must be met for the venting of contaminated vapors associated with operation of the air sparging, SVE, or LTTD; and
- Alaska Solid Waste Management Regulations (18 AAC 60) must be met for proper management and transport of wastes that meet the definition of a RCRA hazardous waste but contain contaminants that exceed cleanup levels.

8.2.5 Information To-Be-Considered

The following information TBC will be used as a guideline when implementing the selected remedy:

- State of Alaska Interim Guidance for Non-UST Contaminated Soil Cleanup Levels (July 17, 1991) for the Building 1168 Leach Well;
- State of Alaska Guidance for Storage, Remediation, and Disposal of Non-UST Petroleum-Contaminated Soils (July 29, 1991) for the Building 1168 Leach Well; and
- State of Alaska Interim Guidance for Surface and Groundwater Clean-

up Levels (September 26, 1990) for both source areas.

8.3 COST EFFECTIVENESS

The selected remedies provide an overall effectiveness proportionate to their costs, such that they represent a reasonable value for the money spent.

8.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREAT-MENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The Army, State of Alaska, and EPA have determined that the selected remedies represent the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner at the OU-2 source areas. Of those alternatives that protect human health and the environment and comply with ARARs, the Army, State of Alaska, and EPA have determined that the selected remedies provide the best balance of trade-offs in terms of long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; cost; and the statutory preference for treatment as a principal element in considering state and community acceptance.

8.5 PREFERENCE FOR TREATMENT AS A MAIN ELEMENT

The selected remedy for each source area satisfies the statutory preference for treatment for soil and groundwater.

9.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy for the DRMO Yard and Building 1168 Leach Well source areas is the same preferred alternative for each area presented in the Proposed Plan. No changes in the components of the preferred alternative have been made.

APPENDIX A

FORT WAINWRIGHT COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT FEDERAL FACILITY AGREEMENT RECOMMENDED ACTION DOCUMENTS

CONTENTS

Source Area	<u>Pa</u>	ge
801 DRUM BURIAL SITE		ii
ENGINEERS PARK DRUM SITE		1
DRUM SITE SOUTH OF THE LANDFILL		
BUILDING 3477		
TAR SITES		
DEFENSE REUTILIZATION AND MARKETING OFFICE YARD		. .
BUILDING 1168 LEACH WELL		
NORTH POST SITE		

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area:

801 Drum Burial Site

Engineer Park Drum Site Drum Site South of Landfill

Recommended Action: Referral from Operable Unit 2 to Operable Unit 1.

<u>Background</u>: A removal action was completed on these source areas in 1992. The information needed to adequately assess further actions was not received in time to meet the schedule of Operable Unit 2. It was agreed by the Project Managers to move these source areas to Operable Unit 1.

Comments:

<u>Approvals</u>: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rulle Marken		2-4-44
Rielle Markey	Date	
Alaska Department of Environmen	ital Conservation	
Remedial Project Manager		
	•	0/1/01
Simo Dodellend		3/4194
Dianne Soderlund	Date	
US Environmental Protection Ager	ncy	·
Remedial Project Manager	-	
US Environmental Protection Ager		2/4/94

Cristai Fosbrook

Date

4 Feb 94

6th Division (Light), US Army Garrison

Directorate of Public Works Remedial Project Manager

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Tar Sites

Recommended Action: No Further Action

Background: After evaluation of all available historical information and interviews with individuals having an institutional knowledge of Fort Wainwright (FWA), site visit and review of analytical data, no further action (NFA) is planned for this source based on one or more of the following reason:

1. 1992 analytical results.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superiund objectives. This approach is based on a conceptual model of this particular source, the ultimate risk to human health or the environment that it represents, and analytical results. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), which was signed by US Environmental Protection Agency (EPA) the Alaska Department of Environmental Conservation (ADEC) and the US Army.

Location: West of the FWA South Post Soccer Field; at Glass park next to Building 4040; northwest of the FWA Golf Course; and west of the power plant cooling pond next to the railroad.

History: Reportedly the sites were used as tar disposal areas. Based on a concern of possible leachate release from these sites, they were included in the FFA as sources that needed further investigation. A sampling effort was conducted in June and July of 1992. The results we summarized in U.S. Army Corps of Engineers memorandum dated October 7th and 15th 1992.

Summary: The criteria used in the decision process for this site is as follows:

 During a 1992 sampling effort the source areas were located and tar samples were collected for Toxicity Characteristic Leaching Procedure (TCLP) analysis; The analytical results indicate that there is no potential for groundwater contamination.

Based on the above information, there is no evidence that a potential source of contamination exists at these sites.

Reference: October 7th and 15th chemical analysis results of the samples collected in June and July of 1992.

Comments:

Future actions with these sites should be coordinated with the Solid waste / Pollution Prevention program of AK. Dept. of Environmental Conservation.

7-25-94

TAR SITES NO FURTHER ACTION

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey

Alaska Department of Environmental Conservation

Remedial Project Manager

Date

Dianne Soderlund

US Environmental Protection Agency

Remedial Project Manager

0/15/94 Date

Cristal Fosbrook

6th Division Light/US Army Garrison ...

Directorate of Public Works

Remedial Project Manager

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Engineer Park Drum Site

Recommended Action: No Further Action (NFA).

<u>Background</u>: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

- 1. In 1992, 680 drums were removed.
- 2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

<u>Location</u>: This source is located on the northeast side of Engineers Park on the south bank of the Chena River. See attached map of source area.

History: Disposal of drums at this location began after the August 1967 flood.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The crum removal activities at this site included removing unburied drums. A total of 680 drums were removed, 613 of the drums found were empty and 67 contained material. The drums contained gasoline, kerosene, degreasing solvents and PCE:
- During a 1992 investigation ten surface soils samples were taken. Low levels of semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations, which were used as conservative screening values. The comparison indicates no unacceptable potential risks to human health or the environment.
- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two soil borings were completed as monitoring wells. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10's Risk-Based-Concentrations and the comparison indicates no unacceptable risks to human health or the environment.
- In both sampling events an observational approach was employed to assure samples represented potential worst case contamination.
- Detected concentrations of soil with Di-n-butylphthalate were determined to be laboratory contaminates.
- All detected concentrations in groundwater data were determined to be laboratory contaminates.

Based on the above information there is no evidence that a contaminant release has occurred at this source area which poses an inacceptable risk to human health or the environment.

References:

<u>Preliminary Source Evaluation 2. Blair Lakes and Drum Sites.</u> Fort Wainweight, AK, Harding Lawson and Associaties, March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I. II. and III, OHM Remediation Services Corporation, February 1993

Comments:

Engineer Park Drum Site-No Further Action

<u>Approvals</u>: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

RIELLE MARKEY Date
Alaska Department of Environmental Conservation

6/16/94

7/25/94

Date

Date

DIANNE SODERLUND

US Environmental Protection Agency

Remedial Project Manager

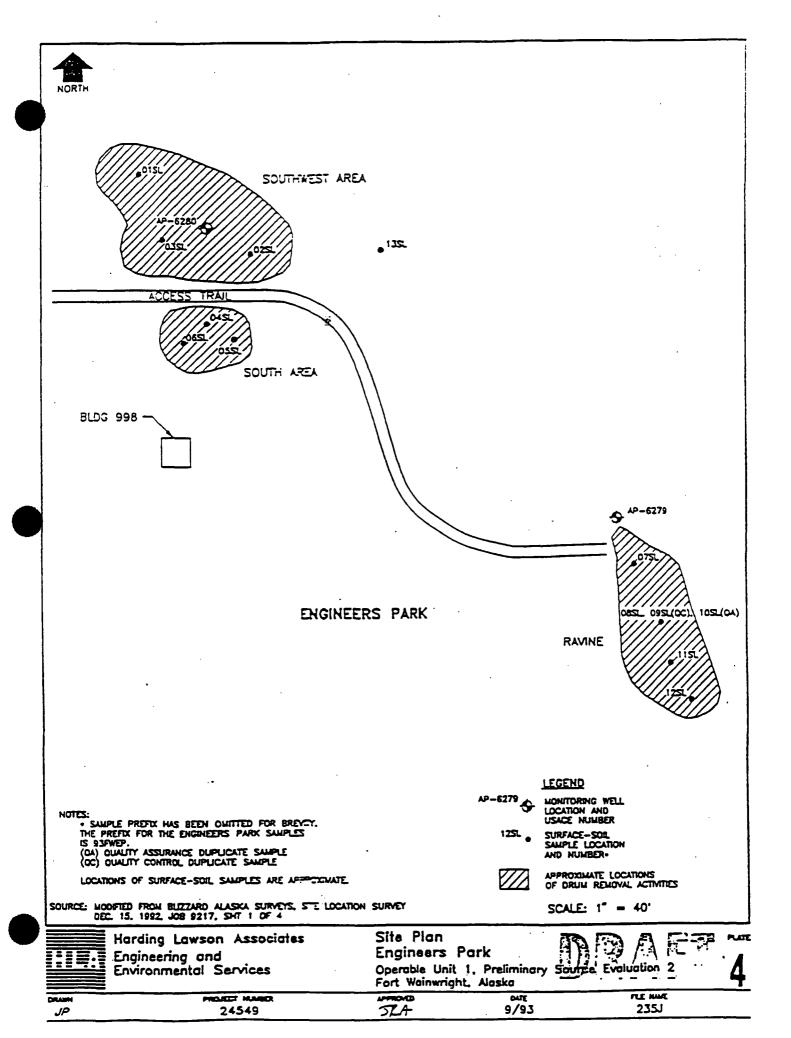
Remedial Project Manager

CRISTÁL FOSBROOK

6th Division (Light), US Army Garrison Directorate of Public Works, Alaska

Remedial Project Manager

121



FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT

RECOMMENDED ACTION

Source Area: Building 3477 - Battery Storage Area

Recommended Action: No Further Action

Background: Based on a review of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright and, if possible, this site, and a limited field investigation. No further action (NFA) is planned for this source based on one or more of the following reasons:

- 1. Interviews with individuals confirming the source existed.
- 2. Results of a 1992 limited field investigation at the source indicates no real potential risks to human health or the environment exists at the battery storage area.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If, at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 2, as designated by the Federal Facility Agreement (FFA), the Alaska Department of Environmental Conservation (ADEC) and the US Army on February 12, 1993.

Location: The battery storage area is located on the east side of Building 3477. Building 3477 is on Chippewa Avenue, approximately 1/4 mile northeast of the South Gate House.

History: Building 3477 was constructed 1955 as a vehicle maintenance facility. The building is currently used for vehicle and equipment maintenance. The site had been used for servicing and storing batteries for an unknown period. These practices were discontinued in 1990, and the U.S. Army contracted for the battery servicing area to be cleaned. The area on the east side of the building

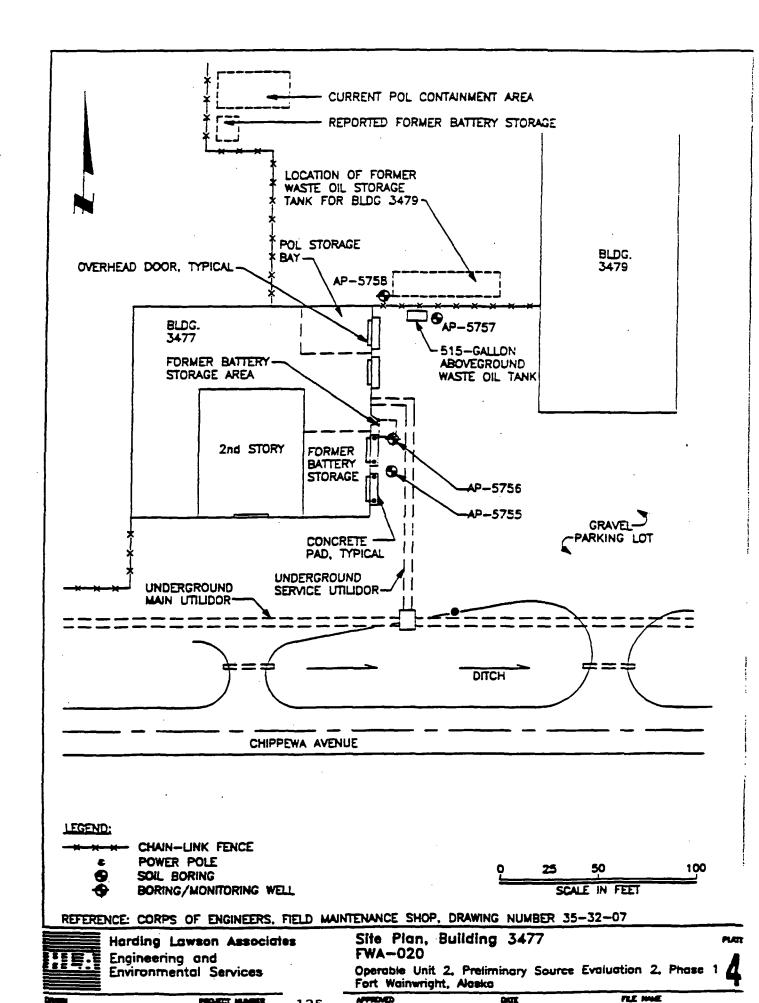
was used for temporary storage of batteries that were to be disposed of. Basec on the potential for contaminant release from this site, it was included in the FF. as a source that needed further investigation through the Preliminary Source Evaluation (PSE) 2 process. A draft PSE report was published November 4, 1992.

Summary: The criteria used in the decision process for this site is as follows:

- During interviews with former US Army personnel, one soldier stated the site was no longer used as a storage area for batteries that were to be disposed of.
- During interviews with current and former employees (the site was identified an area of building 3477).
- During a 1192 limited field investigation samples were collected. The maximum detected site concentrations of the suspected contaminates were compared with EPA Region 10's Risk-Based Concentrations and the comparise indicates no real or potential risks to human health or the environment exists at the battery storage area. Attachment 1 includes a plot plan of this source.
- Based on the above information, there is no evidence that a potential source:
 of contamination exists at this site.

Reference: Final Report. Operable Unit 2, Preliminary Source Evaluation 2, Phase 1, Fort Wainwright. Alaska.; Harding Lawson and Associates, April 23, 1993.

Comments:



HAC

10/92

3T

Approvals: The following project managers, representing their respective agencies which are signatories to the FFA, concur with this evaluation.

Rielle Markey Alaska Department of Environmental Conservation Remedial Project Manager	1/13/94 Date
Dianne Soderlund US Environmental Protection Agency Remedial Project Manager	1/.2/9~ Date
Cristal Fabrush Cristal Fosbrook 6th Division Light/US Army Garrison Directorate of Public Works	13Jan 90 Date

Remedial Project Manager

FORT WAINWRIGHT

CERCLA FEDERAL FACILITY AGREEMENT RECOMMENDED ACTION

Source Area: Drum Site South of Landfill

Recommended Action: No Further Action (NFA).

<u>Background</u>: After evaluation of all available historical information, interviews with individuals having an institutional knowledge of Fort Wainwright, site visits, and review of analytical data, no further action is planned for this source based on the following reasons:

- 1. In 1992. 573 drums were removed.
- 2. Results of 1992 and 1993 limited field investigations.

A systematic, qualitative approach has been used to determine the disposition of this potential source of contamination which is consistent with RI/FS guidance and Superfund objectives. This approach is based on a conceptual model of this particular source and the ultimate risk to human health or the environment that it represents. If at any juncture, additional information becomes available which alters the information used in this decision, the source will be reevaluated.

This decision document will become part of the Record of Decision (ROD) for Operable Unit (OU) 1, as designated by the Federal Facility Agreement (FFA), which was signed by the Alaska Department of Environmental Conservation (ADEC), the US Environmental Protection Agency (USEPA), and the US Army. This source was moved from OU2 to OU1 as part of a Recommended Action dated February 4, 1994.

<u>Location</u>: This source is located on the south of the landfill and includes drum areas, referred to as the east and west drum sites. See attached map of source area.

<u>History</u>: Historical information and records on drum disposal at this location were not available. The site was identified in the RCRA Facility Assessment as a potential source.

Summary: The criteria used in the decision process for this site is as follows:

- A drum removal was conducted in August and September of 1992. The drum removal activities at this site included removing unburied drums. A total of 573 drums were removed, 474 of the drums found were empty and 99 contained material. The drums contained gasoline, kerosene and degreasing solvents.
- During a 1992 investigation eleven surface soils samples were taken. Low levels semivolatile organic compounds were detected. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10 Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP).
- During 1993 ground penetrating radar (GPR) was conducted with no additional drums being located. Additionally, eleven surface samples were taken and two suborings were completed as monitoring wells. Low levels of semivolatile organic compounds were detected in groundwater. The maximum detected site concentration of the suspected contaminates were compared to EPA Regions 10-Risk-Based-Concentrations, which were used as conservative screening values. These levels are within the 10-4 to 10-6 acceptable risk range as specified in 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP). Attachment 2 includes pertinent analytical data.
- In both sampling events an observational approach was applied to assure sampwere taken in areas representing potential worst case contamination.
- Detected concentrations of Di-n-butylphthalate and Bis(2 etthylhexyl)pthaltate is soil were determined to be laboratory contaminates.

Based on the above information, there is no evidence that a contaminant release he occurred which poses an unacceptable risk to human health or the environment.

References:

Preliminary Source Evaluation 2, Blair Lakes and Drum Sites. Fort Wainwright, AK, Harding Lawson and Associaties. March 1994

Final Report for Drummed Waste Removal, Fort Wainwright, Fairbanks, Alaska, Volume I. II, and III, OHM Remediation Services Corporation, February 1993

Comments

Table 4-5. Analytes Detected in Water Samples From the East and West Orum Sites

U.S. Army Corps of Eng	gineers Boring N	umber	AP-6277	AP-6278	AF-5278	
·	Sample N		FWED01WA	FWIDOIWA	FWW,DC2WA	
Land	oratory Sample N	umber	9492-7	9492-8	9492-5	
	Duplicate Oual		N/A	N/A	ÇÇ	
Associated (Project Sample N		A/A	N/A	FWWD01WA	
						=
	EPA Metnodi	Units				
Anaivte		0.11 63	•			
Fuel Quantitation and Identification	'n					
Diesei Fuel (as #2)		mg/L	0.08		ND(0.05)	
Bunker Oil (as #6 Diese))	8015Hª	mg/L	0.34		0.48*	
Gasoline Range Organics	801545	Мо	analytes detected	d above the me	thod reportin	9
Diesel Rance Organics						
DRO	£100M ^b	mg/L	0.19*	0.28	0.25	
Volatile Organic Compounts			•		2 🛊	
Number of TICs	5260	H/A	2	1 ‡ 5 †	ξ <u>Τ</u>	
Sum of estimated TIC concentration	an <u>.</u> 8250	μg/L	16	5 🕆	. 15 中	•
Semivolatile Organic Compounds			-		3.0.5	
Di-n-outy i pritra late	6270	μg/L	15 6	32 B	7 B.E	
bis(2-Ethylhexyl)phthalate	≅270	μg/L	46	ND(10)	10 E	
Number of TICs	ē270	N/A	2	3	ľ	
Sum of estimated TIC concentration	n 3270	μg/L	676	33	8	
Organochlorine Pesticides and PCBs	8080	No	analytes detecte	d above the me	thod reportin	9
Organophosphorus Pesticides	5140	No	analytes detecte	d above the me	thod reportin	9
W1-	•					
<u>Metals</u>	7060	mg/L	0.0036	0.012	0.011	
Arsenic	5010	mg/L	0.2	0.18	0.17	
Barıum Calcium	6010	mg/L		0.10		
**	6010	mg/L		••		
Iron	7421	- mg/L	0.0014	ND(0.0010)	0.0025	
Lead	6010	mg/L	0.0014			
Magnesi um	6010	mg/L			•	
Manganese	6010	mg/L	 			
Potassium						

⁴ U.S. Army Corps of Engineers Hodified Hethod 8015M.

Project Laboratory Qualifiers

Chemical Quality Assurance Report (CQAR) Qualifiers

 $^{^{\}mathrm{D}}$ Alaska Department of Environmental Conservation Modified Methods 8015M and 8100M.

^{- =} Not applicable.

EPA = Environmental Protection Agency.

mg/L = Hilligrams per liter.

M/A = Not applicable.

D = Not detected above method reporting limit shown in parentheses.

PCBs = Polychlorinated biphenyls.

TICs = Tentatively identified compounds.

 $[\]mu$ g/L = Micrograms per liter.

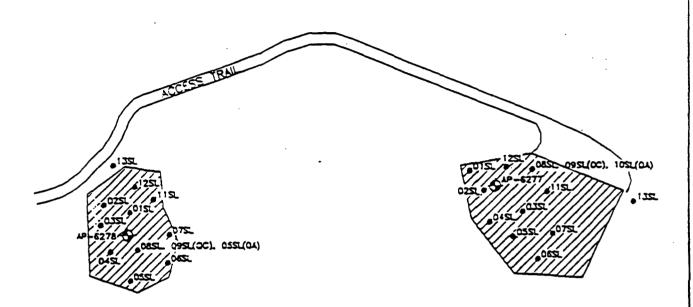
^{8 -} Indicates the analyte was found in the blank as well as the sample.

E = Indicates estimated concentration.

Data should be considered with caution (see COAR, Appendix F).

⁺ The CQAR deem the data unacceptable.





WEST DRUM AREA

EAST DRUM AREA

LEGEND

AP-6279

MONITORING WELL LOCATION AND USACE NUMBER

125L .

SURFACE - SOIL SAMPLE LOCATION AND NUMBER+

APPROXIMATE LOCATIONS
OF DRUM REMOVAL ACTIVITIES

LOCATIONS OF SURFACE-SUL SAMPLES ARE APPROXIMATE.

ES:

SAMPLE PREFIX HAS BEEN OMITTED FOR BREVITY.
THE PREFIX FOR THE EAST DRUM SAMPLES IS
93FWED AND FOR WEST DRUM SAMPLES 93FWWD.

(OA) OUALITY ASSURANCE DUPLICATE SAMPLE

(OC) OUALITY CONTROL DUPLICATE SAMPLE

SOURCE: MODIFIED FROM BUZZARD ALASKA SURVEYS, SITE LOCATION SURVEY OEC. 15, 1992, JOB 9217, SHT 1 OF 4

ile South OF Land Fills



Harding Lawson Associates Engineering and Environmental Services Site Plans
East and West Drum Areas
Operable Unit 1. Preliminary Source

Evaluation 2

Fort Wainwright, Alaska

DALEM PROJECT MARKET APPROVED DATE FLE NAME

JP 24549 JLA 131 9/93 235J

Drum Site South of Landfill-No Further Action

Approvals: The following project managers: representing their respective agencies which are signatories to the FFA, concur with this evaluation.

RIELLE MARKEY Date
Alaska Department of Environmental Conservation
Remedial Project Manager

Dianne Soderlund
US Environmental Protection Agency
Remedial Project Manager

Date

Cristal Fosbrook
6th Division (Light), US Army Garrison
Directorate of Public Works, Alaska
Remedial Project Manager

APPENDIX B

ADMINISTRATIVE RECORD INDEX

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
	Preliminary Radar Survey of a Hazardous Waste							
6/1/86	DumpNorth Post Site	Report	Steven A. Arcone	CRREL	Cristal Fosbrook	DPW	02078	02141
	Endangerment Assessment for FTW 150 Unit							
10/1/86	Family Housing ProjectData Acquisition Plan	Report	None given	URS Corporation	None given	COE	02142	02210
	Confirmation Study: Endangerment Assessment	J]	J	
	for FTW Family Housing Area; included							<u> </u>
4/1/87	Appendices Volumes 1 & 2	Report	None given	URS Corporation	None given	COE	02211	02822
	Risk Assessment for Proposed Family Housing	}	j	Ecology &		}		
11/1/88	Facilities, FTW	Report	None given	Environment	CENPA-EN-PM-A	COE	02823	03102
	Trip Report, Chena Project, IRP Projects on FTW	}					i .	
7/7/89	and Ft. Greely	Memorandum	Georgeanne Reynolds	COE	None given	None given	03109	03116
-4	ADEC Review Comments for Sampling PlanIRP	 -						
7/21/89	North Post Family Housing	Letter	Douglas Lowery	ADEC	Eddie Brooks	COE	05118	05120
	Memorandum for Record: Tar Seepage in the			}		1		
8/15/89	Chena River	Memorandum	Bill Quirk	DEH	File	File	03103	03104
9/7/89	Trip Report, FTW, Ft. Greely	Memorandum	Dan Knight	COE	None given	None given	03105	03108
	Letter Addressing Groundwater Contamination at		<u> </u>	Ecology &		1	1	
2/9/90	North Post Site on FTW	Letter	Jon Sandquist	Environment	Eddie Brooks	COE	05243	05244
	Discussion of Army Request for Interpretation of						1	
	Groundwater Analytical Data and Their Effect on			Ecology &		1		·
2/9/90	Remedial Approach for North Post Site	Letter	Jon Sundquist	Environment	Eddie Brooks	COE	05764	05765
	EPA Review Comments on Project Report for						1	
3/1/90	North Post Site, FTW	Letter	Douglas Johnson	EPA	Col. Edwin Ruff	DEH	03249	03251
	ADEC Review Comments for Draft Project Report			_				
4/3/90	for North Post Site, FTW	Letter	Douglas Dasher	ADEC	Paul Steucke	Env. Res. Div.	03252	03256
	Memorandum for Record, Trip Report, Site					l		
4/9/90	Investigation of 5 FTW IRP Sites	Memorandum	David Williams	COE	File	File	03117	03121
			}	Ecology &		1		
5/1/90	Project Report for the North Post Site, FTW	Report	None given	Environment	Mark Wallace	COE	03122	03241
5/21/90	Notice of Availability and Comment Period	Notice	William Kakel	COE	Public	Public	08303	08303
	ADEC Response to EA & FNSI for North Post	}		}				
6/20/90	Site on Fort Wainwright	Letter	Rielle Markey	ADEC	William Kakel	COE	05240	05242
	Remedial Action Required at North Post Site,					1		
7/2/90	FTW	Fact Sheet	Catherine Scott	US Army	None given	None given	08304	08304
				Fairbanks Daily		1		
9/2/90	Army Monitors Waste Site	Article	Kris Capps	News-Miner	Public	Public	05246	05247
	Design Analysis for Soil Remediation Project at	1		Ecology &				
5/1/91	the North Post Site, FTW	Report	None given	Environment	Mark Wallace	COE	07429	07456
	Review of Planned Removal Action at North Post				1		07.05	07400
5/24/91	Site, FTW	Memorandum	Paul Thies	COE	Cristal Fosbrook	DPW	07425	07428

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
	Bidding Documents for IRP North Post Site Soil		A1	005		0	05040	05000
8/1/91	Remediation, FTW Fort Wainwright Solid Waste Management Units,	Report	None given	COE	Contractors	Contractors	05248	05680
	1991 Site Reconnaissance, FTW Site Safety			ļ				
10/17/91	1	Report	Garson Carothers	Harding Lawson	Mark Wallace	COE	03257	03280
	1 1000	Пороге	darour ourotrioro	Tididing Lawson	Wark Wallaco		0020.	00200
11/20/91	Non-Invasive Site Investigation, SWMU FTW	Report	Garson Carothers	Harding Lawson	CENPA-EN-MB-C	COE	04134	04169
	Site Safety and Health Plan, Preliminary Source			<u> </u>	-			
1/9/92	Evaluation, Fort Wainwright, Alaska	Report	James Slattery	Harding Lawson	Mark Wallace	COE	03281	03358
	DRAFT Chemical Data Acquisition Plan PSE,			9				
2/14/92	FTW	Report	Garson Carothers	Harding Lawson	Mark Wallace	COE	03359	03488
ļ								
5/28/92		Report	Shaun Sexton	Harding Lawson	CENPA-EN-MB-C	COE	03489	03669
	Review Comments for OU2, PSE2, Phase 2			_				
6/23/92	DRMO	Letter	Ronan Short	ADEC	Cristal Fosbrook	DPW	05121	05122
	Review Comments for Draft Scope of Work for		Diame Out at at	504	Orietal Frankrasılı	DDW	05400	05100
6/23/92	OU2, PSE2, Phase 2	Letter	Dianne Soderlund	EPA	Cristal Fosbrook	DPW	05123	05126
7/28/92	Non-Invasive Site Investigation, DRMO, OU2, PSE2, Phase 2	Danad	Candra Dranar	Hardina Lawson	CENPA-EN-MB-C	COE	04170	04189
1120132	FSEZ, Fliase Z	Report	Sandra Draper	Harding Lawson	CENFA-EN-MID-C	US Army, AK	04170	04103
8/12/92	Results of Chemical Analyses	Memorandum	Timothy Seeman	NPDML	Commander	Dist	04190	04223
0/12/32	Preliminary Summary of Invasive Investigation,	METHOLATION	Timothy Seeman	INI DIVIL	Commander	Dist	04100	0.220
8/13/92	SWMU OU2, PSE2, Phase 1	Letter	Shaun Sexton	Harding Lawson	Mark Wallace	COE	04224	04232
	Review Comments for Draft Work Plan for DRMO		Griddii Goxtori	Transing Earroom				
9/8/92	Storage Yard, PSE2, Phase 2	Letter	Cami Grandinetti	EPA	Cristal Fosbrook	DPW	05127	05129
9/17/92	Work Plan, DRMO, OU2, PSE2, Phase 2	Report	William Burgess	Harding Lawson	Mark Wallace	COE	03670	03830
				<u> </u>		<u> </u>		
9/18/92	Site Safety and Health Plan, OU2, PSE2, Phase 2	Report	Sandra Draper	Harding Lawson	Mark Wallace	COE	03831	03950
			,			US Army, AK		
10/5/92	Results of Chemical Analyses	Memorandum	Timothy Seeman	NPDML	Commander	Dist	04233	04238
10/7/92	Chemical Analysis Results: Tar Pit	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04239	04276
					051154 511 55 41		0.4077	04000
	Chemical Analysis Results: Tar Pit 2	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	US Army	04277	04282
10/26/92	Preliminary Summary of Invasive Investigation	Letter	Sandra Draper	Harding Lawson	Mark Wallace	COE	04283	04286
11/1/00	Investigations of Buried Drum Sites by Ground	Danast	Daniel Lawson	CRREL	None given	COE	03242	03248
11/1/92	Penetrating Radar	Report	Daniel Lawson	UNNEL	None given	COE		. 00240
!	 Biodegredation/Volatilization Bench Scale							
	Treatability Study Results for TPH Contaminated							

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
	Review Comments for OU2, PSE2, Phase 1							
1/24/93	Report	Letter	Dianne Soderlund	EPA	Cristal Fosbrook	DPW	05130	05136
	Sampling and Analytical Final Report for					<u> </u>	1	
2/1/93		Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	05766	06775
	Operations Final Report for Drummed Waste			1				
2/1/93		Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	06776	07108
	Health & Safety Final Report for Drummed Waste			 				·
2/1/93	Removal, Ft. Wainwright	Report	Thomas Warren	OHM Remed. Svcs.	None given	COE	07109	07407
	Review Comments for Final Report for OU2,							
3/26/93	PSE2, Phase 2, DRMO	Letter	Ronan Short	ADEC	Cristal Fosbrook	DPW	05137	05138
4/20/93		Report	None given	Laidlaw Env. Svcs.	None given	COE	05681	05691
	Final Report OU2, Preliminary Source Evaluation				1			
4/21/93	2, Phase 1,	Report	Shaun Sexton	Harding Lawson	CENPA-EN-EE-AI	COE	04287	04580
	ADEC Review Comments for Treatability Study,							
4/21/93	North Post Sites 3 & 4	Letter	Rielle Markey	ADEC	Cristal Fosbrook	DPW	07457	07459
	Notice of Violations During Remediation of							1
	Cortaminated Soils at Sites 3 & 4 at North Post					1		
5/20/93	Site	Letter	Rielle Markey	ADEC	Robert Wrentmore	USArmy	07460	07460
	Final Report, Operable Unit 2, PSE 2, Phase 2,				1	1	ì	
	Defense Reutilization Marketing Office, Fort							į
6/16/93	Wainwright, Alaska; 2 volumes	Report	Paul Adel	Harding Lawson	CENPA-EN-EE-AI	COE	23684	24200
	Summary of Soil Sample Results for North Post							
6/17/93	Site Soil Remediation Project	Report	CPT Malsom	US Army	Joe Malen	DEH	07408	07424
	Biopile Work Plan North Post Site Soil					l	İ	
6/21/93	Remediation, FTW	Report	None given	Laidlaw Env. Svcs.	None given	COE	05692	05763
======					.	205	0.4-0.4	05400
7/20/93	Final Report, OU2, PSE2, Phase 2, DRMO, FTW		Paul Adel	Harding Lawson	None given	COE	04721	05103
7/30/93	Work Plan, OU2, PSE2, Support Work	Report	Timothy Gould	Harding Lawson	None given	COE	03951	04133
7/30/93	Results of Chemical Analyses, FTW DRMO	Report	Timothy Seeman	COE-NPDL	CENPA-EN-G-MI	COE	05104	05117
0 (0 (0 0	Final Chemical Data Report for Pond Near	<u>.</u> .				205	05400	05477
8/9/93	Badger Road	Report	CENPA-EN-G-MI	COE	CENPA-EN-EE-AI	COE	05139	05177
8/23/93	DRAFT OU2 RI/FS Management Plan	Report	None given	Harding Lawson	None given	None given	07461	08033
4/0/04	Final Management Plan, Operable Unit 2, Fort					005	04040	25055
4/6/94	Wainwright, Alaska	Report	Michael J. Schmetzer	Harding Lawson	None given	COE	34940	35955
4/00/04	Preliminary Source Evaluation 2; Support Work;	١		Harding Lawson	A 4 - d - NA4 - U	005	01000	01050
4/26/94	801 Drum Burial Site; Fort Wainwright, Alaska	Report	Steven C. Gruhn	Associates	Mark Wallace	COE	21666	21850
	Operable Unit 2; Preliminary Source Evaluation 2;			Mandle				1
4/00/04	Support Work; Building 1168; Fort Wainwright,		0.00	Harding Lawson	Mark Marilana	COF	22000	22210
4/29/94	Alaska	Report	Steven C. Gruhn	Associates	Mark Wallace	COE	22098	22319

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
	Qualitative Ecological Risk Assessment							
	Approach, Remedial Investigation, Operable Unit					1		
7/21/94		Report	Michael J. Schmetzer	Harding Lawson	CENPA-EN-EE-AI	COE	26837	26844
	Groundwater Levels at DRMO and Building 1168,							
7/22/94	Fort Wainwright, Alaska	Memorandum	Delwyn Thomas	COE	CENPA-EN-EE-AI	COE	26735	26754
	Investigation, Site Assessment, and			Oil Spill Technology,				
8/1/94	Recommendations, Building 1168, August 1994	Report	John H. Janssen	Inc.	None given	COE	37864	38125
	Work Plan Building 1168 Treatability Study, Fort							
12/14/94	Wainwright, Alaska	Report	Timothy Gould	Harding Lawson	None given	COE	24842	24900
1								
44.040-	Operable Unit 2 Baseline Human Health Risk	_	l					
1/10/95	Assessment Approach, Fort Wainwright, Alaska	Report	Michael J. Schmetzer	Harding Lawson	CENPA-EN-EE-AI	COE	24735	24764
4/04/05	Interim Report, Building 1168 Treatability Study,		l		l., .	005	07050	20005
1/31/95	Fort Wainwright, Alaska	Report	Joseph W. McElroy	Harding Lawson	None given	COE	27252	29025
E (4 E /0 E	Building 1168 Treatability Study Offgas			Harding Lawson		205	40750	40700
5/15/95		Report	Tim Gould	Associates	Mark Wallace	COE	48750	48766
7/1/05	Final Site Safety and Health Plan, Fort		l	ENSR Consulting	.	205		
7/1/95	Wainwright Buildings 1002, 1168, and 2250	Report	None given	and Engineering	None given	COE		
	Final Work Plan for Release Investigations	1						
=1.10=	Building 1002, 1168, and 2250, Fort Wainwright,	_		ENSR Consulting	İ., .			
7/1/95	Alaska	Report	None given	and Engineering	None given	COE		ļ
	Technical Memorandum, Underground Storage	Ì						
	Tank Release Investigations at the North Post	_	l	Harding Lawson				07040
10/13/95	and DRMO Sites, Project No. 33414 and 33415	Report	J. Robert Allen	Associates	None given	COE	37809	37818
	Final Human Health Risk Assessment, OU2,		_	Harding Lawson		\		
10/16/95	Delivery Order 002	Report	Douglas N. Cox	Associates	Mark Wallace	COE	39929	40222
	Review Comments on Final Human Health Risk			1		1		
	Assessment, Operable Unit 2, Fort Wainwright,	i		US Army Center for				
12/1/95	Alaska, October 1995	Letter	Jack M. Heller	Health Promotion	Mark Wallace	COE		
	Release Investigation Report, North Post Site 4,		Karol Lorraine,	Harding Lawson		1		
12/20/95	Fort Wainwright, Alaska	Report	J. Robert Allen	Associates	Mark Wallace	COE		<u> </u>
	Technical Memorandum, Monitoring Results,						l	
	Building 1168 Treatability Study, Fort Wainwright,		Joseph W. McElroy,	Harding Lawson		1		
1/12/96	Alaska	Memorandum	Timothy F. Gould	Associates	Mark Wallace	COE		<u> </u>
				US Army				
	Request for Extension of Document Deadline for			Directorate of Public		US EPA		ł
1/16/96	the Operable Unit 2 Record of Decision	Letter	Albert J. Kraus	Works	Markey	Reg X; ADEC	ļ	ļ
i				ļ., "	}			
4 (0 - 1	Operable Unit 2 Final Remedial Investigation	<u>.</u> .	Michael Schmetzer,	Harding Lawson		005		
1/25/96	Report, Fort Wainwright, Alaska, Volumes I, II, III	Heport	George Drewett	Associates	Mark Wallace	COE	1	

Original Doc. Date	Title	Document Type	Author Name	Author Organization	Recipient Name	Recipient Organization	Start Page	End Page
	Fort Wainwright Proposed Plan for Remedial Action at Operable Unit 2	Report	None given	None given	Public	Public		
	FONSI and EA for the North Post Site	Report	None given	COE	Cristal Fosbrook	DPW	05178	05239
L	Tar from Old Dump May Seep into Chena River	Article	None given	None given	Public	Public	05245	05245

APPENDIX C

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION FOR REMEDIAL ACTION AT OPERABLE UNIT 2, FORT WAINWRIGHT, ALASKA

OVERVIEW

The United States Army, Alaska (Army); United States Environmental Protection Agency; and Alaska Department of Environmental Conservation, collectively referred to as the Agencies, distributed a Proposed Plan for remedial action at Operable Unit 2 (OU-2), Fort Wainwright, Alaska. OU-2 comprises eight source areas: the Defense Reutilization and Marketing Office (DRMO) Yard, the Building 1168 Leach Well, the North Post Site, the 801 Drum Burial Site, the Engineers Park Drum Site, the Drum Site South of the Landfill, Building 3477, and the Tar Sites.

The Proposed Plan identified preferred remedial alternatives for two of the eight source areas within OU-2: the DRMO Yard and Building 1168 Leach Well. The other six source areas were not considered for remedial action in the Proposed Plan. The soil contamination at the North Post Site consists of petroleum and petroleum-related products and will be addressed through an Army removal action that includes excavation, treatment, and proper disposal of the remediated soil. The 801 Drum Burial Site, Engineers Park Drum Site, and Drum Site South of the Landfill were assigned to Fort Wainwright OU-1 for a more comprehensive investigation and will addressed through that OU's decision process. Finally, no further action is recommended for Building 3477 and the Tar Sites.

The major components of the remedial alternatives for the DRMO Yard are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

The major components of the remedial alternatives for the Building 1168 Leach Well are:

- Soil vapor extraction,
- Groundwater air sparging with natural attenuation, and
- Groundwater monitoring/evaluation.

No formal comments regarding the Proposed Plan for the OU-2 remedial action were submitted during the public comment period.

BACKGROUND OF COMMUNITY INVOLVEMENT

The public was encouraged to participate in the selection of the final remedies for OU-2 during a public comment period from May 1 to May 31, 1996. The Fort Wainwright Proposed Plan for Remedial Action at Operable Unit 2 presents combinations of options considered by the Agencies to address contamination in soil and groundwater at OU-2. The Proposed Plan was released to the public on May 1, 1996, and copies were sent to all known interested parties, including elected officials and concerned citizens. Informational Fact Sheets dated March and September 1995 and March 1996, which provided information

about the Army's entire cleanup program at Fort Wainwright, were mailed to the addresses on the same mailing list.

The Proposed Plan summarized available information regarding the OU. Additional materials were placed into two information repositories: one at the Noel Wien Library in Fairbanks and the other at the Fort Wainwright Post Library. An Administrative Record, including all items placed in the information repositories and other documents used in the selection of the remedial actions, was established in Building 3023 on Fort Wainwright. The public was welcome to inspect materials available in the Administrative Record and the information repositories during business hours.

Interested citizens were invited to comment on the Proposed Plan and the remedy selection process by mailing comments to the Fort Wainwright project manager, by calling a toll-free telephone number to record a comment, or by attending and commenting at a public meeting on May 8, 1996, at the Carlson Center in Fairbanks.

Basewide community relations activities conducted for Fort Wainwright, which includes OU-2, have included:

- July 1992—Community interviews with local officials and interested parties;
- April 1993—Preparation of the Community Relations Plan;
- July 1993—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- July 22, 1993—An informational public meeting covering all OUs;
- April 22, 1994—Establishment of information repositories at the Noel Wien Library and the Fort Wainwright Post Library and at the Administrative Record at Building 3023 on Fort Wainwright;
- March 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright;
- September 1995—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright; and
- March 1996—Distribution of an informational Fact Sheet covering all OUs at Fort Wainwright.

Community relations activities conducted specifically for OU-2 included:

- April 28 and May 1, 5, 6, 7, and 8, 1996—Display advertisement announcing the public meeting in the Fairbanks Daily News-Miner;
- May 1, 1996—Distribution of the Proposed Plan for final remedial action at OU-2;

- May 1 to May 31, 1996—Thirty-day public comment period. No extension was requested;
- May 1 to May 31, 1996—Toll-free telephone number for citizens to provide comments during the public comment period. The toll-free telephone number was advertised in the Proposed Plan and the newspaper display advertisement that announced the public meeting; and
- May 8, 1996—Public meeting at the Carlson Center to provide information, a forum for questions and answers, and an opportunity for public comment regarding OU-2.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD

No comments were received during the public comment period.

APPENDIX D

FORT WAINWRIGHT OPERABLE UNIT 2 SOURCE AREA BASELINE COST ESTIMATES FOR REMEDIAL ALTERNATIVES

BUILDING 1168 SOURCE AREA BASELINE COST SUMMARY

Fort Wainwright OU-2 Feasibility Study Building 1168 Baseline Cost Estimate Summary

Component	Remedial Action Alternative								
	Afternative 1	Afternative 2	Alternative 3	Alternative 4	Alternative 5				
Present Worth of GW Monitoring	\$0	\$81,000	\$29,000	\$29,000	\$29,000				
Present Worth of Capital Costs*	\$0	\$49,000	\$174,000	\$452,000	\$350,000				
Present Worth of AOC	\$0	\$0	\$66,000	\$78,000	\$119,000				
Total Cost to Implement	\$0	\$130,000	\$269,000	\$559,000	\$498,000				

^{*} Includes Direct and Indirect Capital Costs.

GW: groundwater

AOC: annual operating cost

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 1 No Action

Direct Capital Cest - Detail

	'len	Year of OC Espenditure	Garage V	Auto	Unit	Total
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	Manhelit with cover time ster wed.			646.50		10 00
	Printing to testimate (50° average our excessed) with pair displaces and hast trace		l p	#50 15	=	10.00
	Valves and Sittings for each run or promote		٥	150 00	1	10.00
	Besterie trestability test		٥	10.000 00		10 00
SYE Barrens Halls	His estateten (20-feet, 4" duraner, r's C. auger represtated weds)	NA.	0	2,200 00		10.00
	Tranching to fan Intuse (50°, 2° over- everage far each smil, incl. backfull)) 0	120.25		10 00
	Mandale with cover (one per small)			646.50		10 00
	Promy to fairhouse (50" everage ar each well) with pipe resistant and heat trace	1	0	850.15 150.00		10 00
	Yelves and fittings for each run or suping Appliest particle cover to managing paint-circulary and protect piping from traffic		1 :	1,50 00		10.00
	Revent payability test		Ιŏ	10,000.00		10 00
SYUSparge Fan House	Prets Approx	NA NA	-	5,000.00		10 00
	Injection bloom		0	9,051.00		10.00
	Water Separatur		0	1,293.00	-	10 00
	Mest alreageter		0	1,293 00	-	10 00
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	Estraction Movies		0			10 00
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	Sampling perts	· ·	a	387.90		10.00
	Plandary and electrical lent up		ō			10 00
	Equipment contrats		0,	2,876.93		10.00
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	.sam 3.		0			10 00
CTTQ Treatment	(TTD an excessing responding volume)	NA .	- 0	95 96		10.00
	Escavation (in-place values)		0	2.55		10.00
	Maning excertion telfron treatment facility (expended volume)		0	5.25 300.00		10.00
	Confirmatory and sample maryocas- excuration trush, 1 sample/200 CY excurated Trustations testing		0	5,000.00		10.00
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	Company of treatest and at PM tourist tappended volunter		0	0.00		10 00
	Inquert & bactifilitions fill it dispose of treated suits at PW tundfill (expended volume)		0	2.99		10 00
Consess	Can antui	NA.	- 6	1 19		10 00
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1	Construction and treatment		0	9.70	CT	10 00
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Exception Sharing Foreign and Sign Parting	And emission and development 25 feet, 4° demotes, PVC, augus on establid whits: Sharing establishes and removes as worter to depth of 19 feet. 5-feet chan the with high viguency pays.	NA NA	0 3 0	2.950 00 27 80 26 47	lF LF	10 00
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Exception Sharing Foreign and Sign Parting	hed mitsfaten ein dervergness 15 feot. 4° danneter, PVC, auger og vistalied weld; Souried antaktive eint fernera is wester in depth et 19 feot 5-feet chan link keith help-visioners septiming Franklink is weith eint help-visioners septiming Franklink is weith eint einterfaces (saudeng 1168 lens-verzer is wester) Meanter voll	NA NA	0 0 0	2.950 00 27 80 36 47 2.55 160 00	LF CY	10 00 10 00 10 00
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Exception Sharing Forcing and Sign Pasting Francis for Market Exception Oncommutationing at Engineering Com- Disposes that spot Scal at	And mittalson and development (5 feet, 4° demotes, PrC, augering establish white) Sharing establishs and remove a wester in depth of 19 feet 5-feet Canab lank with high-visioners pages Promises for words excertioner (building 1159 lent-vision a wester) Memoriar and Permisesurb establish grate, Licoproper in-place results)	NA NA NA	0 0 0 0 0	2.950 00 27 80 36 47 2.55 160 00 80.00	LF CY ** CY	10 00 10 00 10 00 10 00
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Exception Sharing Forcing and Sign Pacting Francis not Merite Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	Ned mitalation and development 15 feet, 4" darmeter, PVC, augie pig-valatied weld; Shareig ansistation size frequent is wester to depth of 19 feet 5 feet chain this lent heigh isclaims page Framework to wenter exceedings (i.i.a.dept 1158 feet-virgit is wenter) Measter well Permanulor outstalled prote; Escretions in place resulting Naufoig escreviteis to First Wymenright Landfell (expecided volume) Desposal expendent Valency Confirmatory and analige temploticus escretions (risch, 1 Langele 200 CY escrevited) Inspert und place close fiel (expended volume)	NA NA NA NA	0 0 0 0 0 0	2,950 00 27 80 16 47 2,55 160 00 80.00 2,55 5,25 0,00 300.00 2,99	15 27 28 27 27 27 27 27 28 27 27 28 27 28 27 28 28 28 28 28 28 28 28 28 28 28 28 28	10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00
Exception Sharing Forcing and Sign Pacting Francis not Merite Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	Ned mitalation one development (5 feet, 4" darmeter, PVC, augie pig-valatied web); Sharely assistation one frequent is wester to depth of 19 feet Framework to weather acceptions (is author) symm. Pramework or weather acceptions (is author) 1559 (see-version or weetler) Measter well Permanework overtailed prote; Estamption in places eventure; Naufoling occavition to Furt Wannerman Landfell (expended volume) Desposal (expended Volume) Compasal (expended Volume) Compasal (expended Volume) Compasal (expended Volume) Compasal (expended Volume) Well (meastering, SVC, or sporpul reviewer) Permaneworky mitalated prote pramework Compasal protegraments (SVC, or sporpul reviewer) Compasal protegraments (SVC, or sporpul reviewer) Compasal protegraments (SVC, or sporpul reviewer) Compasal protegraments (SVC, or sporpul reviewer) Compasal protegraments (SVC, or sporpul reviewer)	NA NA NA NA	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2,950 00 27 80 16 47 2,55 160 00 80,00 2,55 5,25 0,00 300,00 2,93 160,00 80,00 2,93 160,00 2,93	15 67 68 67 67 67 68 68 68 68	10 00 10 20 10 00 10 00
Exception Sharing Forcing and Sign Pacting Francis not Merite Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	hed mitidation and development 15 feet, 4" darmeter, PVC, augie rig-valatied weld; Souring antiastronic and femoral as worker to depth of 19 feet 5-feet chain link with high visitors repris Promisers for worker according is building 1359 feet-variet as worker; Meanter well Meanter well Formation for worker according is building 1359 feet-variet as worker; Meanter well Experience into place venture; Naming accordinate for feet til powerpat Landfill (expended volume) Disposal (expended Volume) Disposal (expended Volume) Confirmation year landfill beginning to be to the properties of the confirmation of the feet worker with the properties of the feet worker worker. Promiserably antituded proby symmetry Underground pring growner, which bactfill, feet and disease at PM landfill Enginnered pinformation decemberation and stackpling treated and	NA NA NA NA	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2,950 00 27 80 16 47 2,55 160 00 80 00 2,55 5,25 0,00 300,00 2,93 160,00 2,00 10,00 10,00	15 8 8 15 15 15 15 15 15 15 15 15 15 15 15 15	10 00 10
Exception Sharing Forcing and Sign Pacting Francis not Merite Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	hed mitidation and pervisorania. 25 feet, 4° darmeter, PVC, augar ng-natidated webb; Sourcilla parabathoris and fermiora as worker to depth of 19 feet. 5 feet chain limit with help-visuance seption. 5 feet chain limit with help-visuance parabated 19 feet personal processor of the personal parabated parabated (parabated parabated processor). Formation and processor operation. Formation and place youther). Licentifies into place youther. Licentifies into place youther. Licentifies into place youther. Confirmation and place depth to processor operation (mich. 1 sample 200 CT accessor of micro place of the personal youther place of the personal youther place of the personal youther place of the personal youther place of the processor. Confirmation of the personal youther place of the personal place of the personal youther place of the personal youther place of the personal youther place of the personal personal youther youther place of the personal youther place of the personal youther place of the personal youther place of the personal youther place of the personal youther place youther youther place youther youther place youther place youther place youther place youther place youther place youther place youther place youther place youther place youther youther place youther youther youther youther youther youther youther youther youther youther	NA NA NA NA	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2,950 00 27 80 16 47 2,55 160 00 80 00 2,55 5,25 0,00 300 00 2,93 160 00 80 00 2,93 160 00 10,00 10,00 5,25	15 27 28 27 27 28 27 28 27 28 28 27 28 28 28 28 28 28 28 28 28 28 28 28 28	10 00 10
Exception Sharing Forcing and Sign Pacting Francis not Market Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	Red mitalation on development 15 feet, 4" darrette, PVC, auge op valatied welds: Survey anistation see frequent as worker to depth of 19 feet Frameworker remove acceptance in Judgment props Frameworker sentire exceptance in-audient 1159 leve-rezier or worder; Measter well Removement vantalled prote, Elizambion in place quantity Hadding exceptant to Fert Wannerings Landfell (expended volume) Compass (expended Volume	NA NA NA NA	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.950 00 77 80 16 47 2.55 160 00 2.55 5.25 0.00 30 00 2.93 160 00 40.00 2.00 10.00 5.25 1,700.00	LF CY SEE CY CY CY SEE CY SEE CY CY SEE SEE CY	10 00 10 00
Exception Sharing Forcing and Sign Pacting Francis not Market Exception Disconnectioning at Engineering Com- Disconnection of the Exception Disconnection of the Exception Disconnection of the Exception Fort Williamsering	hed mitalation and development 15 feet, 4" darmeter, PVC, augie rup vialatied welds: Source paralation and femorar as worker to depth of 19 feet 5 feet chain this best help-inclusives props Promisely for worker exceedings (handling 1958 feet-rezist as worker) Measter work Permanusch exitation probs Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities (expended Values) Licentities (expended	NA NA NA NA		2.950 00 27 80 16 47 2.55 160 00 80.00 2.55 5.25 0.00 300 00 2.93 160.00 80.00 1.00	LF CY OR OR CY CY OR CY CY OR CY CY OR CY CY CY CY CY CY CY CY CY CY CY CY CY	10 00 10
Lacturation Sharing Francian and Sign Peaching Francian for Martie Excuration Geogramma.	hed mitalation and development 15 feet, 4" darmeter, PVC, augie rig-variatied web); Sourcid parasisation and fermours as worker to depth of 19 feet 5-feet chain link witch help-valuetry septiment. Frameter for worker accordings (Saudetry septiment) Meanter well Meanter well Meanter well Meanter well Meanter well Expression into place youther) Licervices into place youther) Meanter could be pressed. Disposal (aspended Values) Confirmatory sel assept into place according (inch. 1 isospiel/200 CY according the place of the (aspended values) Permittings according to the feet to youther according to the feet of the place of the control of the place of the control of the feet of the fe	NA NA NA NA	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.950 00 27 80 16 47 2.55 160 00 80.00 2.55 5.25 0.00 300 00 2.93 160.00 80.00 1.00	LF CY SEE CY CY CY SEE CY SEE CY CY SEE SEE CY	10 00 10
Liceratum Sharing Funcing and Sign Pacitics Frameum for Worke Exceptation Declaracies. Declaracies. Declaracies. Despute that spot Soil at Fart Westweight Landfill	hed mitalation and development 15 feet, 4" darmeter, PVC, augie rup vialatied welds: Source paralation and femorar as worker to depth of 19 feet 5 feet chain this best help-inclusives props Promisely for worker exceedings (handling 1958 feet-rezist as worker) Measter work Permanusch exitation probs Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities into place venicing Licentities (expended Values) Licentities (expended	NA NA NA NA		2.950 00 27 80 16 47 2.55 160 00 80.00 2.55 5.25 0.00 300 00 2.93 160.00 80.00 1.00	LF CY OR OR CY CY OR CY CY OR CY CY OR CY CY CY CY CY CY CY CY CY CY CY CY CY	10 00 10

ILL: out applicable for this un

RA: and applicable for the PVC: polyropi chlurido SF: square font ST. square yard SVE: sed super extraction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 1 No Action

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to li	nplementation	NA					
	Administration and supervision		9	85.00	br	\$0	
	Design and development		0	75.00	he	\$ 0	
	Drafting	1	0	65.00	ìr	\$0	
	Monitoring and testing (Year O)		o	65.00	hr	\$ 0	
	Project engineering		0	65.00	hr	\$ D	
Subtetal							\$0
Engineering : Decommis	sioning	NA NA					
	Administration and Supervision		0	85.00	h	\$0	
	Design and development		0	75.00	hr	\$0	
	Drafting		0	65.00	hr	\$ 0	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		0	65.00	hr	\$0	
Subtetal							\$0
License Permit/Legal	(10% engineering costs)	NA	0	0.00	ea	\$0	\$0
Start on and Shake Dow	m of Treatment System	NA					
	Materials		0	1,000.00	ea	\$0	
	Labor		0	65.00	hr	\$ 0	
	Equipment		0	1,000.00	ea ea	\$0	
·	Lab Testing	ļ	0	500.00	ea	\$0	
Subtotal							\$0
Coningency	(15% capital costs)	NA	1	0.00	rs	\$0	50
Total Annual Operation		NA NA					*0
	Year	NA			إحسا		10

ea: each

hr: hour

IC: indirect capital cost

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.1 No Action

Annual System Operation Cost Detail

	Item	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cost						NA	T
(Post-Construction)	Item 1: Groundwater monitoring	0		hr	į		\$0
	Item 2: Training	0	f	LS		Ĺ	\$0
Subtotal							\$0
Routine Maintenance Material	r and Labor Cost	<u> </u>		┼	1	NA NA	
	Item 1: Groundwater monitoring annual mainterance	١٠	[ıs	1		\$0
	Item 2: SVE/air sparge well annual maintenance	1 0	l	LS	{		\$0
	htem 3: SVE/ air sparge wor annual maintenance	۱ ،		LS]		\$0
Subtotal	man J. Jack an sparge system annual machematic	<u> </u>		1.5	 		50
Auxiliary Materials and Energy		<u> </u>		 		NA NA	-
manners materials and citally	Process Chemicals		1	ιs	1	117	10
	Electricity	٥		LS			\$0
	Electricity Water	ا ا		LS			\$0
	water Sewer	ة ا		LS			\$0
				LS			\$0
Subtotal	Fuel	0		10	-		\$0
							\$0
Disposal of Residues		<u> </u>		 	<u> </u>	NA NA	1 "
	Wash water, sludge, etc.	ا ا		ιs			\$0
Subtotal							50
Purchased Services				 		NA	1
	Professional Services			1	1		I
	Item 1: Laboratory Fees	0		ιs	1		\$0
	Item 2:	0		LS			10
	Item 3:	o.		LS			10
Subtotal				1		***********	\$0
Other:				┾-	<u> </u>	NA NA	
	face trans-	01		LS		••••	\$0
Administrative costs not included in othe		"		LS			\$0
naurance (1% of capital costs prorated		'		LS			\$0
	coptal Costs prorated far each af veur of treatment) al costs prorated for each year of treatment)	,		LS			· •
Subtotal	a contraction of and bear to the fugal!)			-			\$0
				<u> </u>			 _
Total Annual Operating Cost							\$0
							L

Number of years of implementation:

0

AOC: annual operating cost hr: hour LS: hump sum NA: not applicable for this alternative SVE: soil vapor extraction IC: indirect capital cost

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.2 Institutional Controls

Direct Capital Cast - Detail

	7.eh	Year of OC Expenditure	Ошенту	Rete	Unit	Tetal
Sourger@espurge et ells	find matakama Si ton, 1 1 4" dameter, black eige, dreun weds)	NA NA	0		-	10.0
	Transming to the record (501; 2" deep laverage for each well, stol. beckfill)	1	0			100
	Mattein and come ran as well		0			100
	Prints to travesses 50° overage for each smill with pape insulation and final trace		0		1	10.0
	Valves and furning for size can of paging	i	0		3	10.0
SVE heven Walls	Become transmitr ton Well metallicing 22-test, 4" dameter, PYC, supering extended wells)	- HA				10.0
***************************************	Translating to the same (50°, 2° deep average for each well, sect. bactfill)	"	ة ا			10.0
	Manhalo sera come sera per well)	j] 0	,		10.0
	Piping to turning 50° everage for each well with pape insulation and least trace		٥	850.15	-	\$0.0
	Yahus and firmum ter vaca na of piping		0	150.00	LS	10.0
	Asphalt partice cover to commune shart-circularing and protect pipping from traffic		٥			10.0
Different Cold	Beneal trestands test		0	1 _	1.	10 0
SVL/Sparge Fan House	Profish lamoning	- NA	, o			10.0 10.0
	lejectee meer Weter sammer	Í	1 8			10.0
	Mat disease	1	1 0	1,293.00		10.0
	Ourt heater	1		•		10.0
	Extracture spread		1 0			100
	Condensate recover	l	٥	1,293.00	-	10.0
	Unit heater	i	0			¥0.6
	Destination and street	1	0			\$0.0
	Irlant Certain	I	٥	,		\$0.0 \$0.0
	Instrumentation grassing from	1	0	4,848.75 387.90		10.0
	Planting act authors text on	1	ة ا	•		100
	(quare cores	1	ا ا			100
	[lectrics need-en	1				100
	Lightung	i	۰ ا	200.42	-	10.0
LTTO Treetment	LTTD presence comment comment	NÁ NÁ				10.0
	Errowson (P-mas Pillan)	1	٥			10.tx
	Hading according to from treatment facility (expanded volume)]	,			10.0 10.01
	Confirmations was sample analytical excession (rush, 1 sample/200 CY excessed) Translations became		۱ ،		1	10.0
	Backfill treates and or singual exception (expanded volume)		li			10.00
	Duspase of treated and at PM landfill (expanded volume)	1				10.00
	Import & bacatili cases till if dayussa at treated soin at FW landful (expanded systems		١.	2.98	le,	10 0
Cacpang	Co erus	NA NA	- 0		1	10.00
Solutification (portland comunt)	Mu design tradations factors		0	45,000.00	i\$	10.00
	Economic de company		٥		CY	10.00
	Mixing, purcos	}	0			10.00
	Confermatory and contain qualytical- excessions (rest), 1 sample(200 CY excession)		0			15.00
Engineerad Pde-Biopine	Externition in-manth othersis	NA.	0	2.55		10.00
	Construction and antercompant Translations section	ł	ľ	32.33 10,000.00		\$0.00 \$0.00
	Confirmatory our summy analytical- escavation (rest), 1 sumple/200 CY escavated		ő	300.00		10.00
Engineered Pale-SVE Pale	[ICANDRIA (B-MICH WHIRE)	NA NA		2.55		10.00
·	Construction and transferant	İ	0	32.33		10.00
	Offigur trustment and	i	0	10,344.00	LS .	10.00
	Treptability tarting	1	0	5,000.00		10.00
	Confirmation sail sature assertical- exception (righ, 1 sample/200 CY exception)		0	300.00		10 00
Landforming	Eschalos in-lease against	NA.	0	2.55		10.64
	Construction del traditions		0	9.70 5,000 00		10 ti
		1	٥	3,000 00		10.00
	Treatments and common apparent accounts then 5 approint 200 CV appropriat	1				
Montoneo Wall Installation	Confirmatory and summe assertical escayates trush, 1 sample(200 CY escayates)	<u> </u>	- 2			15,900,00
	Confirmations and common analytical excessions (right, 1 sample) 200 CY excession. In all nettaliances and enviscoment (25-hert, 4" daments. PVC, super rep-manifed weeks.	O NA	2	2,950.00 27.80	8	
scaration Shoring	Confirmatory and summe assertical escayates trush, 1 sample(200 CY escayates)		2	2,950.00	8 5	\$5,900.00 \$0.00
Economic Storing Fencing and Sign Pasting	Confirmation and summe neuroscal escaration lingth, I samples 200 CT escarated. This sustainates and enviscement 125-feet, 4" demonst. PVC, super ny-matellised weeks. Starring automitation and reproduct a wholes to depth of 19 feet.	NA	2	2,950.00 27.80	8 5 5	\$0.60 \$0.00
Montering Wall Instalation Escaration Storing Fairning and Sign Pasturg Francing to Winter Escaration Discontinuous and only	Confirmation and common assertical exception (right, 1 amodel 200 CY in Constact And matcherine and introceptions (25-bat, 4" diameter, PYC, August righters with Source and account on represent and only in section 11 feet	NA NA	0 0	2,950.00 27,80 16.47 2.55 220.00	8 2 5 5 8	10.60 10.00 10.00
Escavation Shoring Fencing and Sign Pasting Francism for William Escavation	Confirmation can assume services escavates (right, 1 amode/200 Cf incovated) in a materiarium sus annequesses (25-test, 4 damente, PFC, augus rig-restalles weeks Starrag as translate inter reserves in wenter in destine 119 fort 6-forto chain sees with high-residenty signs Promoun for estater escavations (Ausding 1168) low-violes in sentiar)	NA NA NA	0	2,950.00 27,80 16,47 2,55	8 2 5 5 8	10.60 10.00
Ecoropen Shoring Fencing and Sign Pesting Pramises for Winter Ecorotees Decementations Uncommissioning with Implementation Dispose History Seef at	Confirmation and common assertical excavation (right, 1 amode) 200 Cf in constact find matchines and environment (25-last, 4 in develop, PVC, Auger righter) execution Scarring actionment and represent a motion is desthied 19 feet 6-feet cleans are with hope-exclusive signs Promount row watch hope-exclusive signs Promount row watch and exclusive signs Alexander and exclusive signships Promount row watch and exclusive signships Promount watch and exclusive signships Alexander except without a contract of the except o	NA NA NA	0 0 0 9 35	2,950.00 27.80 16.47 2.55 220.00 110.00 2.55	2 8 2 4 5 8	10.00 10.00 10.00 11.940.00 23.850.00
Econoten Shoring Fencing and Sign Pasting Pransisin for Wilmer Escandida Decaminissionical width Implementation Dispase History Seef at	Confirmation and assume suprotect excention (right, 1 amode/200 Cf inconsist high entitletons are enveragement (25-text, 4" damenter, PFC, augus rig-restalled weeks Starrag as transition from removed as welfer in deoth of 19 feet Gried chain and with dept-residenty signs Promount for entitier excention (funding 1158 feet-visitor in rental) Harding excention defined (Convention with excention damenter) Harding excessions to Fert (Famouright (astafil (expanded volume))	NA NA NA O	0 0 0 9 35	2,950,00 27,80 16,47 2,55 220,00 110,00 2,55, 5,25	22882658	10.00 10.00 10.00 11.980.00 13.950.00 40.00
Econoten Shoring Fencing and Sign Pasting Pransisin for Wilmer Escandida Decaminissionical width Implementation Dispase History Seef at	Confirmation and common assortical excessions (night, 1 samples 200 CY in constant And ministration and invescement (25-text, 4" diameter, PVC, August rejectables weeks Schreige instantions are represent a sector is early set 19 feet 5-feet chean and wide high-recipiony signs Francisco transmit with high-recipiony signs Francisco transmit and constantion (finalized place) Francisco transmit acceptable (finalized place) Hadron extra ex	NA NA NA O	0 0 0 9 35	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55 5,25 0,00	22288255	\$0.50 \$0.50 \$0.50 \$1.980.50 \$2.950.50 \$0.60 \$0.60
Econoten Shoring Fencing and Sign Pasting Pransisin for Wilmer Escandida Decaminissionical width Implementation Dispase History Seef at	Confirmation and common assertical excavation (right, 1 amode) 200 CY excavated. And materians and environment (25-last, 4 diameter, PYC, Auger rights) and to provide sents. Sourceg activation and represent a meter is denth of 19 feet. 6-feet chain and with high-recipions spile. Primingate now worth high-recipions (finding 1168 laye-water in worter). Hadron may for account (finding 1168 laye-water in worter). Hadron may for account of finding 1168 laye-water in worter). Licentina un-made violence. Licentina un-made violence. Licentina un-made violence. Licentina un-made violence. Licentina un-made violence. Licentina un-made violence. Licentina un-made violence. Licentina un-made violence.	NA NA NA O	2 0 0 9 35 0 0	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55 5,25 0,00 300.00	8 2 2 2 8 2 E 2 E 8	\$0.50 \$0.50 \$1.980,50 \$1.980,50 \$2.950,50 \$0.50 \$0.50 \$0.60
Louvaben Shoring Fencing and Sign Pasting Fencing for Winter Elevision Decembers sensing with Implementation Dispess rist-spit Self at ent Walestright Landfal	Confirmation and common assertical exception (right, 1 amode/200 Cf exception) in all materians and invescence (25-text, 4" deventor, PFC, larger right exception and common an	NA NA NA O	0 0 0 9 35	2,950.00 27.80 16.47 2.55 270.00 110.00 2.55 5.25 0.00 300.00 2.99	ន ១ ១ ១ ខ ន ១ ១ ១ ១ ១	\$0.50 \$0.00 \$1.940.00 \$2.950.00 \$0.00 \$0.00 \$0.00
Leovation Storing Finding and Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding	Confirmation and common emercical excension (right, 1 amode/200 Cf inconsist high entitations and environment (25-text, 4" damentar, PFC, augus righters and to see the consistence of t	NA NA NA O	2 0 0 9 35 0 0	2,950.00 27.80 16.47 2.55 270.00 110.00 2.55 5.25 0.00 300.00 2.99	8 2 8 2 2 2 8 2 5 5 8	10.00 10.00 11.940.00 11.940.00 13.950.00 10.00 10.00 10.00 10.00 10.00 10.00
Econocen Shoring Fencing and Sign Pasting Pransum for Winter Econocen Decembers seeming with Implementation	Confirmation and common assertical excavation (right, 1 amode/200 CY excavation) And maniferrors and invesceptions (25-last, 4" diameter, PVC, apper right exists. Sorring activations and represent sectors is earth of 19 feet. 6 feet chain and with depresentative signs. Primings are sector excellent fileshing 1168 live-water in sectors! Mention made. Foreign activated strate. Excellent in sector extension fileshing 1168 live-water in sectors! Manifer excellent in sector extension fileshing in file (expanded values). Disposed acception feetings. Confirmation or feet Mention fileshing. Confirmation or death of expanded evalues. Medi Leasenton state (Expanded evalues). Medi Leasenton in St. Ex suprept reserved. Participation occurring St. Ex suprept reserved. Participation occurring St. Ex suprept reserved.	NA NA NA O	2 0 0 0 9 35 0 0	2,950.00 27.80 16.47 2.55 270.00 110.00 2.55 5.25 0.00 300.00 2.99	8 8 2 8 2 2 2 8 2 5 5 8	10 05 10 05 10 05 11.940 05 13.850 05 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00
Leovation Storing Finding and Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding	Confirmation and common emercical excension (right, 1 amode/200 Cf inconsist high entitations and environment (25-text, 4" damentar, PFC, augus righters and to see the consistence of t	NA NA NA O	7 0 0 0 9 35 0 0 0	2,950.00 27.80 16.47 2.55 220.00 110.00 2.55 5.25 0.00 300.00 2.99 220.00 110.00	5 8 2 8 2 2 2 8 2 5 5 5 5 5 5 5 5 5 5 5	10.00 10.00 11.340.00 23.250.00 20.00 20.00 20.00 10.0
covaces Storing excess and Sign Fasting forman for Wine Eccaristes formanisms with formanisms excess formanisms excess formanisms formation formanisms formanisms formanisms formation for	Confirmation and common assertical excavation (right, 1 amode/200 CY excavation) And maniferrors and environment (25-late, 4" diameter, PYC, lugar right environment of the confirmation of confirmation of confirmat	NA NA NA O	7 0 0 0 9 35 0 0 0	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55, 5,25 0,000 300.00 2,99 220.00 110.00 2,00	8 4 8 9 8 9 9 9 8 8 9 4 4 8	10.00 10.00 11.940.00 13.950.00 10.0
Leovation Storing Finding and Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding	Confirmation and common enserviced excention (right, 1 amode/200 Cf excention) in all missions and environment in first (2-base). If common PfC, appering-resided weeks Sorring as sussesses from remover in weeks in section 119 feet 6-feet clean and sept washing to supply the property of the feet of the	NA NA NA O	0 0 0 3 35 0 0 0 4 6 110	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55, 5,25 0,00 300.00 2,99 220.00 110.00 2,00 220.00 10.00 5,25	228582828225820558	10 00 10 00 11 00 11 1940 00 23,950 00 10
Leovation Storing Finding and Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding Annual Sign Fasting Finding	Confirmation and common essential exception (right, 1 amode/200 CY exception) in all micharism and represent (25-text, 4" diameter, PYC, apper ng-residies weeks Surraing activations and represent in words in desthird 19 feet 6-feet draws are seed approaching signs Promount for minior escential fillinding 1158 feet-writer in words? Allowers made Considers made Considers made Considers made Considers weeks visitions Undring exceptions to feet if amonths (expended volume) Dispose decreases training Confirmation and complex considers (resident of the considers of the co	NA NA NA O	2 0 0 0 3 35 0 0 0 0 0 110 4	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55 5,25 0,00 300.00 2,99 220.00 110.00 2,00 2,00 2,00 2,00 5,25 1,700.00	8226882222882688	10 00 10 00 11.00 11.340.00 13.850.00 10.00 10.00 10.00 10.00 1880.00 1880.00 1880.00 1880.00 1880.00 1890.00 11.700.00
covaces Storing excess and Sign Fasting forman for Wine Eccaristes formanisms with formanisms excess formanisms excess formanisms formation formanisms formanisms formanisms formation for	Confirmation and assessment assortical excavation (right, 1 amode/200 CY excavation) And maniferrors and invesceptions (25-bet, 4" diseases, PVC, apper right exists. Sorring an investigation and represent as earlier in earth of 19 feet. 6 feet chesh and with depression (disease) Priminates and with depression (disease) Priminates are settled excellent (disease) Resease right excellent excellent (disease) Resease excellent excellent excellent (disease) Resease excellent	NA NA NA O	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2,950.00 27,80 16,47 2,55 220.00 110.00 2,55,55 5,25 0,00 300.00 2,99 220.00 110.00 5,25 1,700.00	5 2 2 2 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	10 00 10 00 11.940,00 11.940,00 10.950,00 10.900
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CT: cabic yeri DC: direct capital cost

LTTD: for tenuments therin
NA: not equicate for the abs
PYC: palyonal classide
SF: square for
ST: square year
SYE: sed square extraction

Fort Wainwright 0U-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.2 Institutional Controls

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to k	nplementation	0		}			
	Administration and supervision		80	85.00	ps.	\$6,800	
	Design and development		80	75.00	μ	\$6,000	
	Drafting		48	65.00	μ	\$3,120	
	Monitoring and testing (Year O)		0	0.00	ea	\$0	
	Project engineering		80	65.00	hr	\$5,200	
Subtotal							\$21,120
Engineering : Decommiss	sioning	30					
	Administration and supervision		8	85.00	щ	\$680	
	Design and development		16	75.00	þτ	\$1,200	
	Orafting		24	65.00	μ	\$1,560	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		80	65.00	þr	\$5,200	
Subtotal							\$8,640
License/Permit/Legal	(10% engineering costs)	0	1	2,976.00	ea ea	\$2,976	\$2,976
Start-up and Shake Dow	m of Treatment System	NA					
	Materials		0	1,000.00	ea ea	\$0	
	Labor		0	65.00	ja	\$ 0	
	Equipment		0	1,000.00	ea	\$ 0	
	Lab Testing		0	500.00	ea .	\$0	
Subtotal							\$0
Contingency	(15% capital costs)	0	1	7,320.90	LS	\$7,321	\$7,321
T			1				\$31,417
Total	Year	0 30	i				\$31,417 \$8,640
	Year	JU		ليحي			¥8,04U

ea: each

hr: how

IC: indirect capital cost

LS: tump sum

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.2 Institutional Controls

Annual System Operation Cost Detail

	ltem	Quantity	Rate	Units	frequency	Yearls) of AOC Expenditure	Totallyear
Operating Labor Cost		i i			1/Year		
(Post-Construction)	Item 1: Groundwater monitoring	20	65.00	hr		1 to 30	\$1,300
	Item 2: Training	11	200.00	LS		1 to 30	\$200
Subtotal							\$1,500
Routine Maintenance M	aterials and Labor Cost			 	1/Year		
	Item 1: Groundwater monitoring annual maintenance	1	500.00	ιs		1 to 30	\$500
1	Item 2; SVE/air sparge well annua maintenance	0		ιs			\$0
	Item 3: Sampling field kit	2	75.00	day		1 to 30	\$150
Subtotal							\$650
Auxiliary Materials and I	Energy					NA	
	Process Chemicals	0		LS			\$0
	Electricity	0		LS	1 :		\$0
	Water	0		LS			\$0
	Sewer	0		LS			\$0
	Fuel	0		LS			\$0
Subtotal							\$0
Disposal of Residues		<u> </u>		 	1/Year		
	Wash_water, sludge, ect.	1	500.00	LS	11	1 to 30	\$500
Subtotal							\$500
Purchased Services		İ			1/Year		
	Professional Services			1	i I		
	item 1: Laboratory Fees	4	625.00			. 1 to 30	\$2,500
	Item 2:	0		LS	i		\$0
	here 3:	0		LS_			\$0
Subtotal					}		\$2,500
Other:				<u> </u>	1/Year		
	included in other line items	0		LS]]		\$0
Insurance		0	0.00				\$0
Taxes, ticensing, permit i		0	0.00	LS			\$0
Maintenance Reserve Fu							
	ated for each year of implementations	1	93.54	LS		1 to 30	\$94
Subtotal							\$94
Total Annual Operatin	g Cost					1 to 30	\$5,244

Number of years of implementation:

30

AOC: annual operating cost hr: how LS: kump sum NA: not applicable for this alternative SVE: sod vapor extraction

Fort Waimwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Direct Capital Cost - Detail

Treatment of the lates (A.) The presence for each and backed		Resil	Year of DC Expenditure	Canadity	Rate	Uest	Tetal
Transfer to the least 50.7 The presenge for seast and sea begunding the form of the presence of the seast of the presence of the seast of the se	Serge Desperae Walts	Wed installation (50 fact. 1 1/4" discorder, black even, driven works)	1 0		1,486 95	-	15,947 80
Mantes with trans tour and 1 14.54 1 17.24	• • •				120.25	-	1481 00
Teams of strongs for any own and prompts Prompts or provision but 100 cm 100		Manhale with cover (one per well)	į.	4	\$45.50	-	12,586 00
Section of the Control of the Cont		Paying to fartness (50° everage for each well) with pape insulation and base trace	1	4	850,15	Ha .	13,400.60
Table Tabl		Yahras and Estança for each run of pipming	1	4	150.00	-	1600.00
Treatment on the search of the seath of th		Binesperge trestability test		0	10,000 00	-	10 00
Madest with some last and and 1 1 144.5 of 1 15.00 13 1	Sei formt mals	Well installation (20-foot, 4" drameter, PVC, super representated weeks)	0	1	2,200 00	-	\$ 2,200.00
Page 14 Inflated TO Arman for each and all and an impaction and teach Years 1 1500 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1100 ft 1 1 1 1 1 1 1 1 1		Transfring to fan happe (50°, 2° does, average for each well, etcl. backfills		1	120 25	-	1120.25
Many and Entropy for seat and an assess 1 15-00 (LT 7 10-00 (LT 7		Manhade with cover (one per med)	}	,	•	1 :	1646 50
Applied marking covers an arrange and mark carming and prime painty tows suffice 1 200 00 1 1 100 00 1 1 100 00 1 1		Picare to forthease (50" average for each well) with post-immission and basis trace	1	1			1850 15
Source Transition for Source Transition fo		Valves and fittings for each run of paying		1			1150 00
1.00 1.00		Asplant surface cover to minimize phore-circuiting and protect puping from walfic	1		1		10.00
March Nature 1,123,200 in 1,100,200 in 1,10				0		_	10.00
Mark cases	DI É Sporge Fran Haussa		0	T = 0		1 1	10.00
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Commerce of the commerce of			į.	١ ;			
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December of the foliage of the control of the con			i	1 ,			10.00
Capacit Control Standard Con				۱ ،			10.00
1 14.44 75 15 13.33 15 13.27				1 ,		7	110,344 00
Sequelar parts 1,000				1;			14,848.75
Production and secretary below of 1,000 00 to 1,000		1		;			1387 90
Tapeare needs				1			11,000.00
Compared Management			}	l i			12,876 93
Uniting material programme misses 1.0 20.47 as 1.0		1 .		0	1,000.00	ss	10 00
Committee Comm							10.00
Media processor to them Determine Number (1,125) (1,125) and ordered (1,125) (1,125) and (1,125) and (1,125) (1,125) and (1,	CTO Treatment	LTTD processing (expanded velopme)	NA.	- 0	96.98	<u> </u>	10.00
Confirmation years as personal marketing (rosh.) surgest 200 CT securetical 0 300 00 0 1.00		Experient (in-place related)	ŀ	0			10.00
Transference Transference 0 0.000 00 15 1.00		Heating exception to from treatment facility (expanded volume)		0			10.00
Redict Stream of transfer all anymort contents (1994) 10 10 10 10 10 10 10 1		Confirmatory and sample analytical-excavation (rish, 1 simple/200 CT excavation	§				10.00
Dispase of Transite and an FM Munifer (separated volume)			l				10 00
Tames Commerce Secretar design of dispase of variety about (Principle (against principle) 1.00 1.19 1.00 1.00 1.19 1.00 1.00 1.10 1.00 1.				, .			10 00
Comparison of the process of the p							
Description partners contains Security securities Profession Controlled (Controlled		longert & becaffil clean fill if diapeze of treated soils at PW landfill (expensed volume)					10.00
Exercision (applicate values) 0 2.55 CT 100	- command	Cap stortal	NA NA	0			10 00
Majoring places 19 19 19 19 19 19 19 1	Sendification (persons comess.)						10 00
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Confirmatory set sample analytical accoverage (rish, 1 sample 200 C* excession) C 2 2,550 00 es 15,500 00 es		Construction and treatment	I	0			10 00
Numbers Numb		·········] .	0			10 00
Example Some institution and resolve in motion to depth of 19 feet RA 0 27.80 E 10.00		Confirmatory sell sample analytical excession (rish, \$ sample/200 C* excursted)	L	0			10 00
Process and Soph Features S-Text Colors and worth high-resolutive signs S-Text Colors and worth high-resolutive signs S-Text Colors and Soph Features S-Text Colors an	Mantanag Red instanction			2.			15.900.00
Pressure for Arctic Ectorition Pressure to worder accessions (basing 1168 (see water in worder) hA	Estate Starting	Stormey annualisation and recovery or wester to depth of 19 fort		0.			10 00
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Permanenty accepted grade 35 110,00 30 13,000 30 13,000 30 13,000 30 13,000 30 13,000 30 3,000 30 3,000 3,				0			10.00
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Fart #Estimate Fast Haufing according to Fart Wainsergic Landfel (organized volume) 0 5.75 CY 10.00		Pernamently assigled probe					33,850.00
Disposal (expanded Values)		1	**				10 00
Confirmation year ample marytical excavoration (resk, 1 xmmar/200 CY excavorated) 0 300,00 0 2,09 CY 10,00	for Manager Landfill		i l	_			10.00
Import and above cleam fell (arpsended verbanes)				-			10.00
Totals							10.00
Well (Intentity ing) removes 10 4 220,00 5 1889 60 10 10 0 10 0 10 0 10 0							
Personantly actabled probe removed	Decommendation of the of Course Action			10			
Underground piping reasonal, treach backfall, hauf and dispose on FM baseffall 2 500 2.00 LF 11,000.00			,5	1 1			
Engineered pile/favilfarm decentryscroon and stackpiling transed and 0 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY 10 00 CY CY CY CY CY CY CY			, !	500			
Hadding treated and its placement orms			'	500			
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Site Institutions 3 1 10,000.00 LS 3 10,000.00 LS 10,			,	"			11,700 00
Confirmatory and sample analytical-trasted sails (1 sample/200 CV treated sail) 3 5 620.00 ex 13,100.00			1 .	, ,			10,000.00
Totals Year 8 (55,527,52 Year 2 515,652.05	ı			, ,			13,100.00
Your 3 11,500.00	etala.			1		-+	(68,637.69
			,	i	l	1	\$18,058.00
				- 1	l	- 1	1888.00

UC. dreet capital cor ex cash FM: Fort Wasseright in: base UF: Same Feet US: base mass

LTTD; how temperature thermid description MA: not explicable for this attemption PVC polymout obtaine ST: repairs feet ST: repairs yeard SYE: sell vapor extruction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Indirect Capital Cost Detail

	Item	Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to b	mplementation	0					
	Administration and supervision		33	35.00	þr	\$6,800	
	Design and development		240	75.00	hr	\$18,000	
	Drafting		1441	65.00	hr	\$9,360	
	Monitoring and testing (Year O)		9:	0.00	ea	\$0	
	Project engineering		240	65.00	hr	\$15,600	
Subtotal							\$49.760
Engineering : Decommiss	sioning	3					
	Administration and supervision		16	85.00	hr	\$1,360	
	Design and development		20.	75.00	hr	\$1,500	
	Drafting		24	65.00	μι	\$1,560	
	Monitoring and testing	j	2	65.00	μι	\$ 0	
	Project engineering		40	65.00	hr	\$2,600	
Subtotal							\$7,020
License/Permit/Legal	(10% engineering costs)	0	11	5,678.00	ea	\$5,678	\$5,678
Start-up and Shake Dow	n of Treatment System	0					
	Materials		1	100.00	ea	\$100	
	Labor		40	65. 00	hr	\$2,600	
	Equipment		j .	100.00	ea	\$100	
	Lab Testing		4	500.00	ea	\$2,000	
Subtotal							\$4,800
Contingency	(15% capital costs)	0	1	23,216.38	LS	\$23,216	\$23,216
						T:	400 600
Total	Year	0		į			\$83,454
	Year	3					\$7,020

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Annual System Operation Cost Detail

	ltem	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	12	65.00	þr		1 to 10	\$780
	Item 2: SVE/AS system monitoring	52	65.00	hr	ļ.	1 to 3	\$3,380
	Item 3: Training	1	400.00	LS		1 to 10	\$400
Subtotal						1 to 10	\$1,180
				<u> </u>		1 to 3	\$3,380
Routine Maintenance Mater					1/year		
item 1: Groundwater n	nonitoring annual maintenance	1	500.00	LS]	1 to 10	\$500
Item 2: SVE/air sparge	system annual maintenance	1	500.00	LS	ļ	1 to 3	\$500
Item 3: Sampling field	kit	1	75.00	day		1 to 10	\$75
Subtotal						1 to 10	\$575
				<u> </u>	<u> </u>	1 to 3	\$500
Auxiliary Materials and Ener	9Y				1/year		
	Process Chemicals	0		LS	i l		\$0
	Electricity (Phase 1)	1	14,200.00	LS		1 to 3	\$14,200
	Electricity (Phase 2)) 0	0.00	LS	,		\$0
	Water	l o		LS			\$0
	Sewer	l o		LS			\$0
	Fuel	1	200.00			1 to 10	\$200
Subtotal						1 to 10	\$200
		4				1 to 3	\$14,200
Disposal of Residues					1/year]
	Wash water, sludge, ect.	1	500.00	เร		1 to 10	\$500
Subtotal			_			1 to 10	\$500
Purchased Services	 				1/year	1 to 10	
Professional Services							1
	Item 1: Laboratory Fees	4	625.00	well]		\$2,500
	Item 2: Engineer review/ consultation	2	65.00	month	! !		\$130
	Item 3:	0		LS			\$0
Subtotal						1 to 10	\$2,630
Other:					1/year	1 to 10	
Administrative costs not incl	uded in other line items	ا ا		LS	1,	1 10 10	\$0
Insurance	aned as other eve statis	اه ا		r2			\$0
Taxes, licensing, permit rener	leus			เร	[\$0
Maintenance Reserve Fund	TT D1	l Y				i	, ,,,
	ted for each year of implementation)	,	889.96	ıs			\$890
Subtotal	securical or sublementations		503.30			1 to 10	\$890
Total Appual Operation Co	st (includes GW Monitoring)					1 to 3	\$24,055 i
inter vising oberating co	ar functiones and withintities.	1 1				4 to 10	\$5,975
		1 1	j		i	7 10 10	13,373
Groundwater Monitorin	g Partion of Total ADC		ŀ			1 to 10	\$3,780

Number of years of implementation:

10

AOC: annual operating cost AS: air sparge hr: hour LS: lump sum SVE: soil vapor extraction GW: groundwater

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1158 - Alternative No. 4 Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soil

Direct Capital Cart - Detail

	Name	Year of OC Expenditure	Ownerty	Rate	i en	Tea
Sourge incomps Walls	Well installation 50-feet, 1-1/4" diameter, black year, driven needs)	1 0	1 4	1,486 95	_	15,847.80
	Well sertalistion 50-fort. 1-1/4" diameter, black yes, driven rests: Trenching to fan house (50", 2" dree- average for each well, incl. buckfill)	•	:	120.25		15,947.80
	Marbale with cover (are for med)	l	١.	646.50		12,586.00
	Prime to favorate (50° everage for each well) with goal insulation and best trace	1	1	850.15		13,400 60
i	Valves and fittings for each run of proses	1		150,00	,	1600.00
1	Biosporge treatability test	1	l i	10,000 80	•	110,000 00
Si (Barmi wets	Well extallation (20 feet, 4" diameter, PVC, sugar reg-excitated wells)	 	1	2,200 80		12,200.00
	Transfering to fan house (50°, 2° drep- overage for each well, std. backfill)	1	1	120.25		1120.25
	Markele with cover (and per well)	'	1 ,	F44.50	•	1648.50
	Piging to fundament (50° diverage for each well) with pipe moutainen and heat trace	1	١ ،	850 15	-	1850.15
l	Yahres and fittings for each run of piping	1	[1	158.80	ιs	1150.00
	Aughalt surface cover to microsite short-circulory and protect populy from traffic.	1	0	8 47	57	10 00
:	Discount trestability test		1			\$10. 00 0.00
SYLISe urge ran neuse	Frefab benasing	0		5,000 80	-	10.00
,	bjection bloom		,	9,051,00		19,051.00
}	Water coperatur	1	۰ ا			10.00
]	Must disminutes	ì	1 '	1,293.00		11,293.00
	Duct leasur	ł		213345		10 00
	Extraction blooms		! !	9,051,00		19,051.00
	Condensate receives	1	'	1,293.80 523.67		11,293.00
	Unit hearter		l "	27.80		10.00
	Door lauver with bird screen Exhaust Controls	1	l "	10,344 80		110,344,00
	Instrumentation (presigns, flow)	1	(;	4.845.75		14,848,75
	Sangling parts	1	;	387.90		1387,90
•	Planting and electrical hase-up	1	i	1,000 00		11,000.00
1	Equipment contrats		1	2,876,93	••	12,876.93
	Electrical bask-up	Į.	٥	1,000 80	-	\$0.00
	Liphing	F	_ 0	200 42	•	10.00
LTTD Transport	LTTD processing (expanded volume)	NA NA	1560	96 34	C	1151,288.80
	Excension (m-place subme)	1	5700	2.56		114,535.60
	Hading excavation tertiram treatment facility (expansion volume)	1	1560			18,190,00
	Confirmatory sell sample tradytical- ascuration (rush, 1 sample/200 CY ascurated)	ľ	29			12,700.00
i	Trestability testing		!	5,000 90		15,000,00
	Backfill treated soil on emploral excevation (expanded volume)					10.00
	Backfill excepted clean sturbarden	1	4400 1560	1.99		18,756.00
	Dispose of treated and at PW broffill (expanded volume)					10.00
	Import & backfill plean fill if dispose of treated sads at PW booffill (expanded suspen)	L	1560	2.99		14 884,40
Catal	Cap estrali	- NA -	- 0	1 13		10.00
Solidification (portional (compant)	Max discripto to contactor y tota lang	i	0	45,000.00 2.55		£0,00 £0,00
	Excensium (in-place volume) Mizing, placing		0			10.00
	Confirmationy and sample institutioni- excessions (repts, 1 sample/200 CY excessions)		ő			10.00
(ngamerus / se- diagnis	Excavation (m-place venume)	14.4	0	2.55		10 00
•	Construction and treatment		0	12.13		10.00
	Treatablity testing		0	10,000.60	LS	10.00
}	Confirmatory sail sample trudytecal-excavation (rest), 1 sample/200 CY excavation		0	300.00		10.00
Engineeris Pier Si E Pile	Escavation (in-place volume)	NA NA	9	2.35	C	10 00
	Construction and transport		0	22.23	CY	10.00
	Offipes treatment upst		0	10,344.90	L\$	10 00
Į.	Trestability testing	i	٥	5,000 00	LS	10.00
	Conference or and sample transporal accessors in the 1 sample 200 CT accessoral					
; and/arming			0		12	10.00
	Excension (in-place religing)	44	0	2.53	ĊY	10.00
	Exception in prace velame) Construction and creatment	44	0	2.55 9.70	CT CT	10.00 10.00
	Excursions on place visions Construction and transpoint Transishing testing	NA.	0	2.55 9 70 5,000 00	67 67 15	10.00 10.00 10.00
	Excivation in place vegints: Construction and trautisms Translativity testing Confirmations sail sample shalvitcal- accession (na.b., 1 sample) 200 CY sacronicad		0	2.55 9.70 5,000.00 300.80	ជ ជ រេ	\$0.00 \$0.00 \$0.00 \$0.00
Montarne évol éstalaban	Exception in place visitings Construction and draughost Transibility texting Construction said sample analytical- acception (right, 1 sample 200 CY sacception) Well extallation and development (75-fort, 4" damentar, PYC, sugar rip-reclaimed whits)	0	0 0 0	2.55 9.70 5,000.00 300.00 2,950.00	67 67 15	10.00 10.00 10.00 10.00 10.00
Montany work installation Escentially James	Escavation in place visions: Construction and traignism Transitability testing Transitability testing Confirmation was assigned analytical- accession (risch, 1 samples 200 CY as coverand: Well entialistics and development (25-fort, 4" diameter, PVC, augm ny enclaring conta) Shoring installation and crossorial in contact to depth of 19 fort	0 3	0	2.55 9.70 5,000.00 300.00 2.950.00	ព ព នេ	10,00 10,00 10,00 10,00 15,900,00
Montarus Avoi Actalistes Eschwisse James Fences ale Sign Parting	Excursions on prace internet Construction and treatment Frantablery testing Confirmation and provinces—excursions (reads, 1 samples 200 CY excursions) Confirmation and development (25-fort, 4" diameters, PVC, super repire called antital) Shorting institutions and development and events for depth of 19 fort 6-fort chain less with high-wealthing inject	0 3 NA	0 0 0 0 2 370	2.55 9.70 5,000.00 300.00 2.950.00 27.80	ច ម ម ម	10,00 10,00 10,00 10,00 15,900,00
Montarus Avoi Actalistes Eschwisse James Fences ale Sign Parting	Escavation in place visions: Construction and traignism Transitability testing Transitability testing Confirmation was assigned analytical- accession (risch, 1 samples 200 CY as coverand: Well entialistics and development (25-fort, 4" diameter, PVC, augm ny enclaring conta) Shoring installation and crossorial in contact to depth of 19 fort	0 3	0 0 0	2.55 9 70 5,000 00 300,00 2,950 00 27 80 16 47 2.55	ច ម ម ម	10,00 10,00 10,00 10,00 15,900,00 18,896,00 10,00
Montering ned notalization Escandia Sharing Fencing see Sign Pinting Framework with Escandon Deciminationing at experiment espen	Escayation in place visions: Construction and draugitions Tripstability testing Construction and anythical-accession (risk), 1 sample: 200 CY saccessed: Well established and development (25-fort, 4" diameter, PVC, augus representation with a Shoring established and development (25-fort, 4" diameter, PVC, augus representation with a Shoring established and development (25-fort, 4" diameter, PVC, augus representation with a Shoring established and accession and evidence of 19 fort F-fort channel has write logi-versions (building 1168 lear-wester in severer) Meaning the second of the contraction of building 1168 lear-wester in severer)	0 3 NA	0 0 0 2 370 0 5700	2.55 9 70 5,000 00 300.80 2,950 00 27 80 16 47 2.55 220 90	8 25 C C C C C C C C C C C C C C C C C C	10.00 10.00 10.00 10.00 15.90.00 18.896.00 10.00 114.535.00
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Manytyring neo nettalaban Estamatus Jenning Fencing sea Jose Pasting Frames wa Poster Detamatication Estamatication	Exception in place respirals Construction and exactions Transition's testing Confirmation was isometic accession (risch, 1 sample/200 CY accession) Well entitations and environment (25-fort, 4" desertin, PVC, augus rip-nectation availated Well entitations and environment (25-fort, 4" desertin, PVC, augus rip-nectation availated Shoring institutions and referenced in center to depth of 19 fore Financial testing the high-receiving senter to specific (19 fore) Financial testing accession to found to pulsaring 1158 leien-resists on venter) Meneter units Financial testing accession to found with the sentence of the pulsaring accession to found Williams Dispectal (expended Vellumin) Handing accessions to four Williamsonghis Landfell (expended volume) Dispectal (expended Vellumin)	0 3 NA 1 0	0 0 0 2 270 0 5700 8 35 0	2.55 9 70 5.000 00 300,80 2.956 00 2.956 00 2.7 83 16 47 2.55 220 00 110 00 2.55 5.25 8.00 300 80 2.29 220,00 220,00		10.00 10.00 10.00 10.00 15.900,00 18.896,00 11.65,00 11.750,00 12.850,00 10.00 10.00 10.00 10.00 10.00 10.00
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Manytaring ned destalation Escarcians Serving Fencing not stop Posting Fromuse was stop Posting Decommissioning at separated stops Uspace not may See at Fort Wasserings Loodfal Despinnessaming at End of Channel Action	Exception in place reagnes Construction and exception Construction and exception Confirmation and exception Confirmation and services Confirmation and services Well notalistics and exceptions (725-fort, 4" diameter, PVC, expering-nectating arisks) Schoring restations and exceptions (725-fort, 4" diameter, PVC, expering-nectating arisks) Schoring restations and renteriors deposit of 19 feet Foliat chain less with high-excepting pages Framework in the proceeding pages Framework restation in basis of pages Framework restation process Framework restation process Framework restation of pages Framework restation process Framework restation pages Framework restation Framework restation Framework restation Framework restation of the process Framework restation of the process Framework restation of the process Framework restation of the process Framework restation of the process Framework restation of the process Framework restation of the pages Framew	0 3 NA 1 0 0	0 0 0 2 270 5700 8 35 0 0 0	2.55 5.000 00 300.80 7.952 00 7.952 00 118 00 118 00 2.55 2.70 00 118 00 2.55 8.00 300.80 2.90 110.80 110.80 5.25 1,700.80		10.00 10.00 10.00 10.00 15.900.00 18.836.00 11.855.00 11.750.00 12.850.00 10.00 10.00 10.00 10.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00
Manytyring even destallation Escandare Sharing Fencing less sign Pietong Fromware les reverse Escandare Decemberations of supermentation Dispasse neit met Son at Fart Witnessings Lendfall Decemberationing at End of Chamate Action	Exception in place vesimes Construction and drautions Threat sharty testing Confirmations and isometic study income the construction (rich, 1 sample) 200 CY according Confirmation and isometic study income to depth of 19 feet Well excellations and involvement (25-fort, 4" diameter, PVC, asper rip not using events) Sharing vestilations and involvement in events to depth of 19 feet 6-feet chain less with laph-scaleful region Fractions for withing they excelled region Fractions for withing a contions (building 1168 feet-wester in weeter) Meaning visible grades Licevision ton-place vesimes Licevision ton-place vesimes Maring visible grades Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision ton-place vesimes Licevision vesimes Licevision Vesimes Licevision Licevision Licevision Vesimes Licevision Licevis	0 3 8A 1 0 0	0 0 0 2 270 5700 8 35 0 0 0	2.55 5.000 00 200.80 2.950 00 2.950 00 2.950 00 2.55 220.00 118 00 2.55 5.25 5.25 5.20 220.00 118 00 2.99 220.00 118 00 2.99 220.00 118 00 2.99 10.00		10.00 10.00 10.00 10.00 15.300.00 18.896.00 10.00 11.8535.00 11.750.00 12.850.00 10.00 10.00 10.00 10.00 10.00 10.00 10.00 11.000.00 10.00 11.000.00
Mantering von notalistes Estantian Sharing Estantian Sharing Francing are Sept Parling Pramiers or norther Estantian Decommissioning at imprementation Copanie norther sensition Fart Housenges Loudid Decommissioning at End of Chemic Action	Exception in place reaches Construction in place reaches Construction and discretion Construction and discretion Confirmation and service inscription (rish, 1 sample/200 CY sicewood) Confirmation and environment (25-fact, 4" dismeter, PVC, expering the sales entite) Well establishes and environment (25-fact, 4" dismeter, PVC, expering the sales entits) Sharing restablishes and rehipf excellent as experient to depth of 19 feet Sharing restablishes and rehipf excellent groups Framework the entit high-excellent region Framework the entit high-excellent place Meacter until	0 3 NA 1 0 0	0 0 0 2 270 5700 8 35 0 0 0	2.55 5.000 00 200.80 2.950 00 2.950 00 2.950 00 2.55 220.00 118 00 2.55 5.25 5.25 5.20 220.00 118 00 2.99 220.00 118 00 2.99 220.00 118 00 2.99 10.00		10.00 10.00 10.00 10.00 15.900.00 18.896.00 11.855.00 11.750.00 12.850.00 10.00 10.00 10.00 10.00 10.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00 11.000.00

CY: cabic seré CC: direct capital cont

LTTO: New transportations thermal description III on applicable for this oftensione.
PYC: polymoir coloride.
ST: agours foot.
ST: square yord.
STE: swill vapor extraction.

ir: hay Uf: facer had US: hay ma

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 4 Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soils

Indirect Capital Cost Detail

	ltern	"ear of IC Expenditure	Quantity	Rate	Units	<u> </u>	Cost
Engineering: Design to Ir	nplementation	0					
	Administration and supervision		80	85.00	hr	\$6,800	
	Design and development	1	240	75.00	hr	\$18,000	
	Drafting		168	65.00	hr	\$10,920	
	Monitoring and testing (Year O)		0	0.00	ea	\$0	
	Project engineering		240	65.00	hr	\$15,600	
Subtotal							\$51,320
Engineering : Decommiss	ioning	3					
	Administration and supervision		60	85.00	hr,	\$5,100	
	Design and development		100	75.00	ħr	\$7,500	
	Drafting		96	65.00	hr	\$6,240	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		160	65.00	pt	\$10,400	
Subtotal						i	\$29.240
License!Permit/Legal	(10% engineering costs)	0	1	8,056.00	ea	\$8,056	\$8,056
Start-up and Shake Dow	n of Treatment System	0					
	Materials		1	100.00	89	\$100	
	Labor		40	65.00	hr	\$2,600	
	Equipment		1	100.00	ea	\$100	
	Lab Testing		4	500.00	69	\$2,000	
Subtotal							\$4,800
Contingency	(15% capital costs)	0	1	63,824.86	LS	\$63,82 5	\$63,825
_							
Total	Year	1 -					\$128,001
	Year	3					\$29.240

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No.4 Alternative 3 Plus Excavation and LTTD of Contaminated Unsaturated Soil

Annual System Operation Cost Detail

	ltem	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totaliyear
Operating Labor Cos					1/year		I
(Post-Construction)	Item 1: Groundwater monitoring	12	65.00	hr		1 to 10	\$780
	Item 2: SVE/AS system monitoring	52	65.00		l	1 to 3	\$3,380
	Item 3: Training	1	400.00	LS	L	1 to 10	\$400
Subtotal	_					1 to 10	\$1,180
		1		<u></u>	<u> </u>	1 10 3	\$3.380
Auxibary Materials a	na Energy	T			Tiyear		
	Item 1: Groundwater monitoring annual maintenance	1	500.00		ł	1 to 10	\$500
	Item 2: SVE/AS system annual maintainence	1	500.00	ı		1 to 3	\$500
	Item 3: Sampling field kit	1	75.00	day	ļ	1 10 10	\$75
Subtotal					l	1 to 10	\$575
		<u> </u>		<u> </u>	<u>1</u>	1 to 3	\$500
Auxiliary Materials as	nd Energy	}			1/year		
ĺ	Process Chemicals	0		LS	•		\$0
	Electricity (Phase 1)	1	14,200.00	LS	ł	1 10 3	\$14,200
	Electricity (Phase 2)	0		LS			
	Water	0		LS	l		\$0
	Sewer	0		ιs		,	\$0
	Fuel	1	200.00	ιs		1 to 10	\$200
Subtotal				Γ		1 to 10	\$200
					<u> </u>	1 to 3	\$14,200
Disposal of Residues					1/year		
	Wash water, sludge, ect.	1 1	500.00	LS		1 to 10	\$500
Subtotal					-	1 to 10	\$500
Purchased Services					1/year		
Professional Se							1
	Item 1: Laboratory Fees	4	625.00	1	j	1 to 10	\$2,500
	Item 2: Engineer review/ consultation	[2	65.00	month		1 to 10	\$130
	ttem 3:	0		LS			\$0
Subtotal				!		1 to 10	\$2,630
Other:					1/year	1 to 10	<u> </u>
Administrative costs	not included in other line items	0		LS	1		\$0
Insurance		0		LS	ł		\$0
Taxes, ticensing, pern	nit renewal	0		LS			\$0
Maintenance Reserve	Fund]
(5% of capital cos	ts prorated for each year of implementation)	1	2.446.62	LS			\$2,447
Subtotal						1 to 10	\$2,447
						14-3	425.545
Total Annual Opera	ting Cost (includes GW Monitoring)	i i				1 to 3	\$25,612
		1 1				4 to 10	¥7,532
Groundwater M	onitoring Portion of Total ADC					1 to 10	\$3,780

Number of years of implementation:

10

AOC: annual operating cost AS: air sparge ea: each hr: how SVE: soil vapor extraction GW: groundwater

Fort Waimwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 5 Alternative 3 Plus Excavation and Engineered Pile Treatment Giopile or vapor extraction pile) of Contaminated Soil

Direct Capital Cost - Ostail

	T(Ca	AN IN the constitution	1 JOHNST	, जिल्ला (क	V4FT	TROI
уржук визрагуе масс	free extension (50-180); 1-114 "denetic, prack may direct was:	-	1	1,480,93		15,547.8
	Trenching to fan louse (501, 21 deep-average for each well, incl. bect/\$80	1	1 1	120.25		1481.0
	Manhalo with cover (one per well)		1 1	646.50		17,588.0
	Pricing to fundament (50° everage for each well) such pipe accelerate and based trace		1 :	850.15		13,400.6
	Valves and fittings for each run of pump	į.	1 :	150 00		1600.0 110.000.0
SVE/Rovers Walls	Bies purge creatablere test			Z200.00		\$10,000.0
STOTOMEN WOLL	Well extellation (20-loot, 4" character, PVI, supplying extellad wells)	•	1 ;	120.25		1120.1
	Treaching to fan bease (50°, 2° deep-overage for each well, etcl. becaffil) Manhole with cover (and ser well)		1 ;	645.50		1648.5
	Prince to favorage (50' average for each well) with pape mealston and heat trace		1	850.15		1850.1
	Yahvas seni fittings for each run of piping		1	150.00		\$150.0
	Asphalt seriace cover to minimum chart-circuing and protect pains from traffic			1		10 0
	Bi-invest trestability test		1 1	10,000 00	ts	\$10,000.0
SVE/Sperge Fan House	Prefair housing	7	7	5,000.00		10.0
	Injection Money		1	9,051.00		¥9,051.0
	Water superator		•			10.0
	May abrunatur		1	1,293.00		£1,293.0
	Duct heater		0			10.0
	Estraction blower		'	9,051.00		19.051.0
	Condensate receiver		1 1	1,293 00		11,293.0
	Unit basis		1 :	523.67		\$0.0 \$0.0
	Door leaver with hird screen			27.80		
	Exhaust Centrels	1	:	18,344.00		110,344.0
	Instrumentation (pressure, flow) Satisfing ports	1	} ;	387.90		14,646.4
	Straping ports Phyriding and electrical heak-up	1	1 ;	1,000.00		£1,000,6
	Equipment centrals	1	;	2,876.93		12,876.9
	Electrical bask-up	1	ءَ ا			\$0.0
	Lighting	ı	٥	.,		10.0
LTTU Treatment	[TTU processing (expanded volume)	- w	 	95 98		30.0
	Excursteen (in-place volume)		0	2.55	CT	30.00
	Handing excevation telfrem treatment facility (expended volume)	1	0	5.25	C7 :	10.0
	Confirmatory sail sample poplytical-excurston (reck, 1 sample/200 CT excureted)	1		300.00		60.0
	Treatability testing	į.	0	5,000.00		10.0
	Backfill treated sed in original exception (expended volume)		0	2.57		\$0.0
	Dispese of treated and at FW famifil (expended volume)			0.00		10.0
	Impure & backfill clean fill if dispose of treated soils at PM landfill (expension) volumes		0			10 0
Capping Seleffication (portland coment)	Cop matel	- "	1 -	1.19 45.000.00		10.0
Seminarion (barasia canent)	Mil designi trantability testing Exception (in-place volume)		;			10.0
	Mixing, placing		;			10.0
	Confirmatory and a propin analysical-excavation (resh.) sample/200 CY exceveted		1 .	300.00		10.0
Enganeered Pile-Biopile	Lichritian (in-place volume)		5/00	2.55		114,535.0
	Construction		1560	32.33	CT	150,434.8
	Import and backfill clean fill if do not bean excensions gave for filling after weatheast		1560	2.99		14,564.4
	Bathfill exceptated close prorbation		4400	1.99		18,750.0
	Trestability tasting		1	10,000.00		110,000.0
	Confirmatory seil sample analytical- excursion (math, 1 sample/200 CY excurerad)		29	300 00		10,700.0
Ingreered Pile-SVL Pile	Exclusions (ni-place values)	NA.		2.55		10.0
	Construction and treatment		٥	32.33	-	10.0
	Office treatment set	ì		19,344.00 5,000.00		0.01 0.01
	Treatability testing Confirmetory and agreein analytical exception treat, 1 sample(200 CY excepted)		Ö	300.00		10.0
Landarming	Exception (in place volume)	 	- 	2.55		10.0
	Cost truction and treatment	_	١	9.70		10.0
	Trustability testing			5.000 00		10.0
	Confirmatory and semale analytical- excevenies (rush, 1 sample/200 CY excevened)		0	300.90		10.0
Menstering Well Installation	Well statellation and development (25 Tool, 4" diameter, PVC, larger rie outland some:	- 		2.350.00	120	15 900 0
scovetien Shoring	Sharing installation and removal in wenter to depth of 19 feet	3	32 L	27.BU		18.896.0
rencing and Sign Pasting	b-last chain link with high-issibility signs	XX.	5	16.47	LF	10,0
remem for Winter Escavation	Fromage for winter excernises (Building 1168 low-water in winter)	1	5700	2.55		114,535.0
Decementationing at Implementation	Mention well		-	720.00		\$1,760.0
	Permanently statisfied probe		35		•	13,050.0
Jupese Her-spet Soil at	Ezcaverion (in-place volume)	IU.				10.0
fert Wannergist Landfell	Frames accessor to Fart Walmonght Leaded (expended volume)		0	5.25		10.0
	Dispusal (expended Velume)	_i	0	0.00 300.00		10.0 10.0
	Confirmatory sail sample analytical-excuration (rash, 1 sample/200 CY excurated) (report and place clean fill (expended volume)	1	0	2.99		10.0
Accommissioning at End of Cleaning Action	Well (SVE, or apergal ramoval	1	10	2.99		12,200.0
Annual or the St Annual Vicini	Well (Insuritaring) retrieval	1 10	4	220.00		12200.0
	Parametry sectolled probe removal	1 1		110.00		10.0
	Underground paper received, trutch backfill, lend and dispose at PW bandfill	, ,	500	2.00		11,000.0
	Expinented pilothootherm documentation and stackpring treated and	5	1	10.00		110.0
	Hading treated sell to placement tree	5	il	5.25		15.2
	For house decommissioning and removal	1	- 1	1,700.00		£1,700.0
	Site registration	5	1	10,000.00		110,000.0
	Confirmatory soil sample analytical	, ,	5	620.00	.	13,100.0
elala		w - 1			_	188,637.1
	I v.	 1				1128,621.2
	1			1		
		19		1	ı	\$10,815.21 1000.00

CT: cubic yard DC: direct capital cent

LTTD; how temperature thermal description
RA: not explicable for this attanuates
PVC, polyvised otherids
ST: square feet
ST: topare yeard
SVE: sed report attraction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 5 Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to Im	plementation	0					
	Administration and supervision		80	85.00	hr	\$6,800	
	Design and development		240	75.00	hr	\$18,000	
	Drafting		168	65.00	hr	\$10,920	
	Monitoring and testing (Year O)		0	0.00	ea	\$ 0	
	Project engineering		240	65.00	hr	\$15,600	
Subtotal							\$51,320
Engineering : Decommissi	ioning	3					
•	Administration and supervision		60	85.00	hr	\$5,100	
	Design and development		120	75.00	þr	\$9,000	
	Orafting		96	65.00	hr	\$6,240	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		200	65.00	hr	\$13,000	
Subtotal						Year 3	\$33,340
License/Permit/Legal	(10% engineering costs)	0	1	8,466.00	ea	\$8,466	\$ 8.466
Start-up and Shake Down	n of Treatment System	3					
	Materials		1	200.00	63	\$200	
	Labor		40	65.00	68	\$2,600	
	Equipment		1	200.00	ea	\$200	
	Lab Testing		4	500.00	ea	\$2,000	
Subtotal							\$5,000
Contingency	(15% capital costs)	0	1	48,927.05	LS	\$48,927	\$48,927
	Year	0					\$108,713
Total	Year	3					\$38,340

ea: each

hr: how

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - Building 1168 - Alternative No. 5 Alternative 3 Plus Excavation and Engineered Pile Treatment (biopile or vapor extraction pile) of Contaminated Soil

Annual System Operation Cost Detail

	Item	Quantity	Rate	Units	Frequency	Yearls) of AOC Expenditure	Totalivear
Operating Labor Cost					1/year		
(Post-Construction)	tem 1: Groundwater monitoring	12	65.00	hr		1 to 10	\$780
	item 2: SVE/AS system monitoring	156	65.00	hr		1 to 3	\$10,140
	Item 3: engineered pile system monitoring	64	65.00	hr		4 to 5	\$4,160
	item 4: Training	1	400.00	ιs		1 to 10	\$400
Subtotal				T		1 to 10	\$1,180
]	i			4 to 5	\$4,160
		1]	ļ	1	1 to 3	\$10,140
Auxiliary Materials an	d Energy	T			1/year		
	item 1: Groundwater monitoring annual maintenance	1	500.00	LS	i l	1 to 10	\$500
	item 2: SVE/air sparge system annual maintenance	1 1	1,500.00	LS		1 to 3	\$1,500
	item 3; engineered pile system maintainence	16	65.00	hr		4 to 5	\$1,040
	tem 4: Sampling field kit	1 1	75.00	day	j i	1 to 10	\$75
Subtotal						1 to 10	\$575
			İ			4 to 5	\$1,040
						1 to 3	\$1.500
Auxiliary Materials and	1 Energy	Ť		_	1/year		
, , , , , , , , , , , , , , , , , , , ,	Process Chemicals	l 0	i	LS	",		\$0
	Bectricity (SVE/AS)	1 1	14,200,00		1	1 to 3	\$14,200
	Electricity (Engineered pile)	i	2,000.00	6		4 to 5	\$2,000
	Water	ة ا	2,000.00	LS			\$0
	Sewer	٥		LS	1		\$0
	Fuel	1	200.00			1 to 10	\$200
Subtotal		+	200.00	-		1 to 10	\$200
345:0:0 /				}		4105	\$2,000
						1 to 3	\$14,200
Disposal of Residues		† 			T/year		
	Wash water, sludge, etc.	1	500.00	ιs	''	1 to 10	\$500
Subtotal						1 to 10	\$ 500
Purchased Services				-	1/year	-	_
	Item 1: Laboratory Fees (G.W. monitoring)	4	625.00	well	·	1 to 10	\$2,500
	item 2: Engineer review/ consultation (G.W. treatment)	2	65.00	month		1 to 10	\$130
	Item 3: Engineer review/ consultation (engineered pile)	16	65.00	LS]	4 to 5	\$1,040
	Item 4: Laboratory Fees (engineered pile)	13	500.00	ea	1	4 to 5	\$6,500
Subtotal		1				1 to 10	\$2,630
						4 to 5	\$7.540
Other:		† 			1/year	1 to 10	
	ot included in other fine items	ا ا		LS	.,,,,,	1,0.0	\$0
Insurance	of archaeca at other mile itchis			LS			\$0
Taxes, licensing, perms	r renewal			LS			\$0
Maintenance Reserve i		1 1					•
	crorated for each year of implementation)	1 1	1,875,54	19	1		\$1.876
Subtotal	storates for each year of supramentations	 - 	1,070.04	-		1 to 10	\$1,876
		<u> </u>					
Tetal Annual Operati	ng Cost (includes GW Monitoring)					1 to 3	#32,801
		1 1			1	4 to 5	\$21,701
						6 to 10	\$6.961
Groundwater Mo	aitoring Partian of Total AOC	1	•			1 to 10	\$3.780

Number of years of implementation:

10

AOC: annual operating cost AS: air sparge hr: hour LS: tump sum SVE: soil vapor extraction GW: groundwater DRMO YARD SOURCE AREA
BASELINE COST SUMMARY

Fort Wainwright OU-2 Feasibility Study DRMO Yard Baseline Estimate Summary

Component	Remedial Action Alternative								
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5				
Present Worth of GW Monitoring	\$0	\$146,000	\$89,000	\$89,000	\$132,000				
Present Worth of Capital Costs*	\$0	\$34,000	\$1,426,000	\$1,498,000	\$2,062,000				
Present Worth of AOC	\$0	\$0	\$680,000	\$682,000	\$698,000				
Total Cost to Implement	\$0	\$180,000	\$2,195,000	\$2,269,000	\$2,892,000				

^{*} Includes Direct and Indirect Capital Costs.

GW: groundwater

AOC: annual operating cost

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 1 No Action

Direct Capital Cost - Detail

Sparges Bestarange Wells Trecking to first installation (50° Feet, 11)4" districtor stack each week, sinch backfell) Marbotic earth cover (some per week) Private part Sections of the per week of the per week well with open residential and have trace Valves and fittings for each rise of promp Bistoping to translation (20° feet, and promp Bistoping to translation (20° feet, and open rise states week) Trenching to the house (50° of distriction) Marbotic estate cover (some per week) Private for the traces (50° mercape for each well, such backfell) Marbotic estate cover (some per week) Private for translation (50° mercape for each well with pipe statefall) Aschalt surfaces cover to enumerate short constroing and protect points from traffic Bevent treatablishes the statefall SYELSparge from House Private focusing imperious feeting Martin distriction belower Water appearant Martin distriction belower Condensate receiver Unit heater Extraction belower Condensate receiver Unit heater Extraction belower Sampling parts Planning and electrical head-up	NA NA	3 3 3 5 5 0 0 0 0 0	859.15 150.00 10.000.00 2.200.00 120.25 646.50 850.15 150.00 8 47 10.000.00	27 27 20 20 20 20 20 20 20 20 20 20 20 20 20	10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00 10 00
Trenching to fam loose (SO', 2' deep were age for cach wolf, incl backfel) Marchine with cover (see per weld) Pring to Enthman (SO' permaps for each wolf) with ope modification and heat trace Valves and firtings for each may of pomp Bisaparge treatedary test Well antidation (20 leas, 4' demictor, PYC, augur no entailed wells) Tranching to fam hisses (SO', 2' deep were age for each well, sect backfel) Matches with overe (see per well) Pump to familiar (SO' inverse) for each well with page assistation and heat trace Valves and firtings for each may depend Application for each may depend and protect poping from traffic Bevent treatability tast SYELSourge fam House Water expension Water expension Matchesimination Duct bester Extraction bleveer Condensate receiver Usel bester Over leaves with bird screwe Extraction for each each each Instrumentation (pressure, flow) Sampling and electrical head-up.		0 0 0 0 0	120 25 646 50 859.19 150 00 10.000 00 2.200 00 120 25 646 50 850 15 150.00 8 47 10.000 00	27 27 20 20 20 20 20 20 20 20 20 20 20 20 20	10.00 10.08 10.00 19.00 10.00 10.00 10.00
Marbale seria cover (see per well) Point is farthese 150" reverse for each well seria ope resistation and less trace Valves and fittings for see see him of prome Bet present value Translating to farthese (70 feet, 4" desmetir. PFC, super new states wells) Translating to farthese (50", 2" deep over apr for each well. Sectiful) Marbale with over (60", 2" deep over apr for each well over back field) Point to farthese (50" average for each well seria association and heat trace Valves and fritings for each raw of points Asbalts serial cover to expert well. Syll-Sparge Fan House First house First house First house First house Water appeared Matt dismeter Out bester Et records belower Condensate recover Usin bester Over levere with and screwer Et least Centrals Instrumentation (prassure, flow) Sampling ports Funding and electrical head-up		0 0 0 0 0	646 50 850.15 150.00 10.000.00 2.230.00 120.25 646 50 850.15 150.00 8 47 10.000.00	23 23 23 24 25 25 27	10.00 10.08 10.00 19.00 10.00 10.00 10.00
Point to Farthman (SO) overage for each wolf with ope and stone and heat trace Valves and fittings for each run of puring Brispose treatments team. SYLIBevent Walts: Well assistance (20 laws, 4" describe, PVC, augus my extained wells) Transching to first houses (SO), 2" deep average for each wolf, each haciful) Mathelia with over (see per mell) Power for thinkees (SO) working for each wolf) with spec assistance and heat trace Valves and firtings for each run of puring Aughant surface cover to exeminate phort-concurring and protect piping from traiffic Bevent transchiffin test SYELSparge from House Prefait houses Frefait houses Extra count bevower Water caper etter Note deliverer Outs bester Extra count belower Condensate receives Usification Over leaver with bard screen Extra count for assistra, flow() Sampling parts Puriting and described head-up		5 3 0 0 0	150 00 10,000 00 2,200 00 120 25 646 50 850 15 150,00 8 47 10,000 00	63 63 63 57	10 00 19 90 10 00 10 00 15 00 10 00
V shus and fittings for each run of promp Bisoprep in treat stating to the state of 10 feet, 4" desmotts. P.V.C. augur rup-assisted wed(s) Transfering to firm houses ISO", 2" deep lover app for each wed, such localified) Machalis entric review per wed(s) Premy to farchisses ISO" earning for each wed(s) with pure actual on and heri traces Valves and firtings for each run of apping Asphila surface cover to assessment short-consump and protect poping from traffic Bevent treatability test SVEISparge from House Perfait houses Perfait houses Unit destinated Dust bester Est action blowver Condessate recover Unit house Est action blowder Over laware mich bard screwn Est action blowder Over laware mich bard screwn Est action blowder Over laware mich bard screwn Est action blowder Condessate recover Unit houses Est action file for the screwn Est action file for the sc		0 0 0 0	10,000 00 2,200 00 120 25 646 50 850 15 150,00 8 47 10,000 00	60 60 1.5 57	10 00 10 00 10 00 10 00 10 00
SYE/Beresen Walts Well excitation (20 feet, 4" damenter, PYC, auger ng-excitates wells) Trunching to ten heaves (50", 2" deep ever ager less social sech backfell) Marchele verto cover (ene per well) Pennig to farcheur (50" average for each well) enth pea exculston and heat trace Valves and fittings for each read appeng Author) surface cover to enemants short-or cutting and protect paping from traffic Bevent translation to secure to enemants short-or cutting and protect paping from traffic SYE/Sparge Fan House Profite house Victor apperatur Mist alleminator Durt heater Condensate i accorde Unit heater Over flavour with bard across Exhaust Centrals Instrumentation (prassura, flow) Sungleg parts Plumbing and electrical head-up		5 0 0 0	2,730,00 120,25 646,50 850,15 150,00 8,47 10,000,00	60 60 60 63 63 57	10 00 10 00 15 08 10 00 10 00
Transising to farm beauty (20°C), 2° deep over app for each well, each backfell) Machiele with cover (see per well) Penny to farmbase 60°C warrage for each well with page activation and heri trace Valves and firtings for each real of apping Authority or strace cover to meanure short-concurring and protect poping from traffic Devent trivialshiny test Prefair boossing Lispiction blever Mater alementary Mater alementary Dust beater Eth actions lidewer Condessate recover Unit beater Condessate recover Unit beater Candessate recover Unit beater Candessate (secretal) Instrumentations (prassure, flow) Sampling parts Plumbing and described head-upp		0	120 25 646 50 850 15 150.00 8 47 10,000 00	65 65 57	10 00 15 06 10 00 10 00
Matchels with cover (one per med) Pring to Enthuse (GC) increage for each well with price acculation and hert trace Valves and firtings for each run of apong Authorit surface cover to minimize short-circuting and protect paping from traffic Bewest treatability tast Pirtab bossen United the cover of the cover o	NA	0	646 50 850 15 150.00 8 47 10,000 00 5,000.00	65 1.5 57	10 00 10 00 10 00
Priming to Farchaman (SOT average for each well) with supe assistance and heat trace. Valves and fittings for each raw of puring. Asphalt surface cover to mammare short-cororting and protect point from traffic. Sevent threstability test First all housing Lipicition blooser Water appearate. Mist distributed Out leaster Estraction blooser Condensate recover Unit bester Over leaver with land screen. Exhaust Centrals Instrumentation (prassure, flowr) Sampling parts Pumbing and electrical head-up.	NA .	0	\$50 15 150.00 \$ 47 10,000 00 5,000.00	1.5 57	10 00 10.00
Valves and fritings for each run of purps Asphalt surface cover to measure short-corouting and protect points from traffic Bewell the subdivir test Prefab housing Lipicities Memor Water superates Mast definition Duct leaster Extraction belower Condensate receive Unit heater Unit leaster Extraction there There is no extraction of the second of the se	NA .	0	150.00 6 47 10,000 00 5,000.00	27 23	10.00
Asphalt surface cover to examinate short-or cuting and protect paping from traffic. Bevent treatabling test Perhal bossing Lipicition belows Water appearate Maint eliminature Duct bester Extraction belower Condessate receiver Unit bester Deer layer onth ber of screwer Child bester Deer layers with bird acrows Extraction between Condessate receiver Unit bester Deer layers with bird screws Extraction of screwer Extraction of screwer Condessates according to screwer Unit bester Deer layers with bird screws Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Extraction of screwer Unit bester Deer layers out bird screwer Extraction of screwer Extraction of screwer Extraction of screwer Extraction of screwer Extraction of screwer Extraction of screwer Extraction of screwer Extraction of screwer Extra	NA .	0 3 3 0 0	8 47 10,000 00 5,000.00	57	
Several treatability tast First his houses Uniform his houses Water caper attre Mat diminister Duct heater Extraction blewer Condensate receiver Unif heater Over louver with hird scrives Extraction (or asserts) Instrumentation (or asserts) Furthing and electrical head-up	MA	0 3 0 0	10,000 00 5,000.00	1	10.00
SYEJSpargu Fan House Prefab houseung Injection Moneur Water separater Anist eleminatur Duct heater Extraction blower Condensate receiver Unit heater Once fourmer with hard screene Extraction for separater of separate	HA	3 0 0	5,000.00	lıs	,
Lejection Movem Water appearan Mist deminister Duct heater Extraction bleveer Condensate receiver Unit heater Occor louver with bird scriven Exhmat Centrals Instrumentation (grazient, flowr) Sampling parts Plumbing and electrical head-up	NA -	0 0 0			10 00
Water apparatum Make diminister Duct heater Estruction bleveer Condensate receiver Unit heater Oper locare with bird scriven Eshmest Centrials Instrumentation (prassers, flow) Sampling parts Pumbing and electrical head-up		0		ea .	10.00
Miss of minimator Duct leaster Estraction blower Condensate receive User leaster User leaster Once four-en with hard screen Estmant Controls Instrumentation (prassure, flow) Sampling parts Plumbing and electrical head-up		0	9.051.00	-	10.00
Duct heater Erroration bleveer Condensate receive Unit heater Deer louver with bird screen Exhaust Centrals Instrumentation (prassure, flowr) Sampling and electrical heak-ap			1,293 00	-	10.00
Erraction blever Condensate receiver Unit heater Deer leaver with lard screen Exhaust Centrals Instrumentation (grassers, flow) Surpleageurs Punching and sectional head-up	;		1,293.00		10.00
Condensate receives User leaster Once fearure with land screen Extense Controls Instrumentation (grassers, flow) Surphing parts Plumbing and electrical head-up		9	2,133,45	-	10.00
Unit heater Dear lawer with burd screen E these C Centrals Instrumentation (grathers, flow) Sampling parts Punding and dectrical head-up		0	9.05100	m	10 00
Coor louver with bird screen Exhaust Centrals Instrumentation (prassure, flow) Sampling parts Plumbing and electrical healt-up		٥	1,293.00		10 00
Exhant Centrals Instrumentation (grassins, flow) Sampling parts Plumbing and electrical head-up		0	523.67		10 00
Instrumentation (prassure, flow) Sampling parts Plumbing and electrical head-up		9	27 80		10 00
Sampling parts Plumbing and electrical healt-up		٥	10,344.00		10 00
Plumbing and electrical head-up		0	4,848.75		10 00
1 .		۰ ا	387 90		10 00
		9	1,000 00		10 00
Equipment controls		0	2,876.93		10.00
Electrical hook-up		1 1	1,000.00		10 00
Lighting		0			10 00
LTTD Treatment LTTD processing (a) parallel volume)	HA	٥	56 98		10 00
Excavation (in-place volume)		0	,		10 00
Hading excession te/from treatment facility (expanded volume)		0			‡0. 00
Configurationy and sample analytical- exception (risk, 1 sample/200 CY exception)		0	300.00	1 1	10 00
Trestability testing	i	0			10 00
Backfill tremed and in original accounts or command watered		٥	1	1	10 00
Dispess of trested sed of PW landful (expanded volume)		- 1	0 00		
Import & backfill clean fill if dispose of treated seds or PM landfill (expanded volume)		D	2.99		10 00
Capping Cap ats Lati	HA	3	1,19		10 00
Solidification (portland consent) Miz design/treatablety testing		5	35,600.00		10 06
Exceration (in-place vinume)		0	2.55	,	10 00
Micros, places		0			10 00
Confirmatory sei sample analytical- excuration (rush, 1 sample/200 CY excuyese)		_			10 00
Enganeered Prin-Bospole (s. place valuate)	MA	. 0	2.55		10.00
Construction and treatment					10 00
Treptability tasting Cathinatery soil sample analytical- excavation (not), 1 sample/200 CY excavated			10,000 00		10 00
Engineered Pilo-SVE Pilo Econvation (in-place valuate)	NA.		2 55 32.33		10.00
Construction and treatment			10,344 00		10 00
Offges treatment error Treatment vivo					10 00
Confirmatory and sample analytical- excessions (rests, is amulai 200 CY excession)	i	3	300.00		10 00
	NA		2.55		10 00
Landfamhing Excavation (in-place volume) Construction and treatment	~*		9 70		10 00
Construction and treatment Treatment teating	ļ	0	5.000 00		10 00
Confirmatory and complete analytical excuration (rest, 1 complet/200 CY excurated)	ļ	- 1	300 00		10 00
West installation Well installation Well installation when it is not development (25 foot, 4" during PVC augus no installed weeks)	NA		2.950 00		10 3C
Figuretion Shoring Shoring Shoring inclusions and connect in sector to doors of 19 fort	NA NA		2,330 00		10 00
Fancing and Sepi Posting 5- foot chan lank with high withinth Lights	NA NA		16 47		10 00
Printings for Worker (scaretism) Printings for wonter acceptance (Statement of 168 few waster or wonter)					10 00
	NA		2.55		
O accommussorming at Intellegement accommon Meanter week Permanentiv variabled probe	74	9	220.00		10 00
				1	
Outpose Not-sport Soil of Excension (in-place values)	MA	ů O	2.55 5.25		10 00
Fort Wainweigh Landfill Haging accordant to Fort Wainweight Landfill (aspended volume)	1	9	-		10 00
Dispectal (expendent Volume) Conformatory coll atmosph analytical exceptions (rects, 1 atmosphi/200 CY exception)		0			10 00
		ő	2,99		10 00
I manus and street fell and a street and and a street		0	220.00		10.00
Import and place clean fill (aspended volume) Description of first of Discon Arters Well (marriages of first of Discon Arters Well (marriages of first of Discon Arters)	~	اة	110.00		10.06
Decembers stated at Classics Action Wall (mountaining, SVE, or operator) removal	l	اه	2.00		10.00
Decembers survived of Cleaning Action Will (monitoring, SVE, or appript removed Parameters outsided probe removed		ű	10.00		10.00
Decembers surving at End of Cleaning Action Will (monstoring, SVE, air appright removed Parameterity installed probe relineved Underground piping removest, arench backfill, hauf and despece at FW landfill	I	ů	10.00 5.25		
Decembersanning or End of Cleanup Action Wall (monstorms, SVE, or sporge) removed Paramountly instituted probe related Underground polying resount, transfer backfill, hauf and depose or FW tentfill Engineered polying			5.25	LT	
Decembersanning or End of Cleaning-Action Wall (monotorms, SVE, or sparge) removed Partnessedly installed probe released Underground piping removed, crosch bockfill, hand and despose or FW tentifill Expineered pilefemblirms deconstructions and stackpling treated anil Rading treated anil to placement prop					10.00
Occanionazzaning at Led of Cleanip Action Wall (monstorms, SVE, air sporge) removed Particularly visit affect product contents Underground piping removed, transch backfill, had dispose or FW landfill Engineered pilefordfilms deconvolvation and stackpling trasted and Nating trasted and seasoned street Fin house documentaming and removal		0	1,700.00		10 00
Decembezzanning or Led of Cleanay Action Wall (meetering, SVE, air sporge) removed Paramentally installed probe released Underground poling removed, created backfill, hand and despose or FW trendfill Empiosered polinteriers decembrated and stackpuling treated and Radiag treated and to advantage and a successful to a second stackpuling treated and Sta restantage and removed Sta restantage.		0	1,700.00	ıs	10 00 10 00
Decembersaming or End of Cleanay Action Wall (meastering, SVE, or sparge) removed Partimentally incitable grate removed Underground polying removed, remote backfill, hand and despose or FW tradfill Employered polying framework polying framework of stackgoing treated sail Radfing treated sail to placement area Fin hearts decommensaming and removed Sta restardom Confirmationy and sample analytical-treated sails (1 sample) 200 CY treated sail)			1,700.00		\$0.00 \$0.00 \$0.00
Decembersanning of End of Cleaning Action Wall (monstorms, SVE, or sporge) removed Paramountly installed probe removed Underground polying removed, transch bacchill, hand and depose or FW treeffill Engineered politicalisms decountrictions and stackpulsing system and Randing transcelland to placement area Fins house documentationing and removal Site restauration	NA NA	0	1,700.00	ıs	10 00 10 00

LTTD: low temperature therhold descript
RA: not applicable for this alternative
PVC: polywork observle
ST: separe foot
SY: separe yard
SVE: sell vapor extraction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 1 No Action

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Quantity	Rate	Units	Cost	
Engineering: Design to Implementation		NA					
	Administration and supervision		0	85.00	hr	\$ 0	
	Design and development		0	75.00	hr	\$ 0	
	Drafting	j	0	65.00	hr	\$ 0	
	Monitoring and testing (Year 0)		0	65.00	hr	\$ 0	
	Project engineering		0	65.00	hr	\$ 0	
Subtotal				,-			\$0
Engineering: Decommissioning		NA NA	<u> </u>				
	Administration and supervision		0	85.00	hr	\$ 0	
	Design and development		0	75.00	hr	\$0	
	Drafting		0	65.00	hr	\$D	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		0	65.00	hr	\$0	
Subtotal							\$0
License Permit/Legal	(10% engineering costs)	NA	0	0.00	ea	\$ 0	\$0
Start-up and Shake Down of Treatment System		NA					
	Materials		0	1,000.00	ea	\$ 0	
	Labor		0	65.00	hr	\$0	
	Equipment		0	1,000.00	ea	\$0	
	Lab Testing		0	500.00	69	\$ 0	
Subtotal							\$0
Contingency	(15% capital costs)	NA	1:	0.00	LS	\$0	\$0
<u> </u>						-	
Total Annual Operating Cost Year		NA NA					\$0 \$0
	Year	NA NA					30

ea: each

hr: hour

IC: indirect capital cost

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.1 No Action

Annual System Operation Cost Detail

	ltem	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cost		T				NA NA	
(Post-Construction)	item 1: Groundwater monitoring	0		hr	ł		
	Item 2: Training	0		LS			\$
Subtotal							56
Routine Maintenance Materials and Labor Cost		†	Ī			NA NA	
	Item 1: Groundwater monitoring annual maintenance	0		เร			\$1
	Item 2: SVE/air sparge system annual maintenance	0		LS			
	Item 3: Sampling field kit	0		day			1
Subtotal							\$(
Auxiliary Materials and £	nergy	 	<u> </u>	†	 	NA	
	Process Chemicals	0		LS	}		. \$
	Electricity (Phase 1)	0	1	LS	•		*
	Electricity (Phase 2)	0		LS			
	Water	0		LS			
	Sewer	0		LS			31
	Fuel	0	<u> </u>	LS			\$1
Subtotal		1	ļ				50
		1					S(
Disposal of Residues		T		十一		NA	
	Wash water, sludge, ect.	0		rz			
Subtotal	-			1)		\$6
Purchased Services				Ť		NA	
Professional Service				i	1		1
	Item 1: Laboratory Fees	0		LS	-		1 *
	Item 2: Engineer review/ consultation	0	Ī	LS	[
Subtotal	Item 3:	0		LS			\$1
		<u> </u>		<u>L</u>			
Other:						NA	
	included in other line items	0		LS			\$0
nsurance		1		LS			\$1
Taxes, licensing, permit re		1 1) (LS.			\$1
Maintenance Reserve Fun			_				}
(5% of capital costs prorated for each year of implementation)		 1		S			\$(
Subtotal							50
Total Annual Operating	Cost						
oto. Amisor operating	••••						

Number of years of implementation:

1

AOC: annual operating cost hr: hour LS: hamp sum

NA: not applicable for this alternative

SVE: soil vapor extraction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 2 Institutional Controls and Natural Attenuation

Denot Coptal Cost - Detail

	Itse	Year of DC Expension	-	Rata	Uast	Total						
Sparges Bessperger Wells	Well extellation (50 host, 5.1.4" describe, deact you, driven wells:	NA.	0	1,486.85		10.00						
	Transiting to tan book 591, 21 deep overage by each well, stal, bacadill)	I	0			10.00						
	Mathele with cover law per smile	ł	0			19,90						
	Piping to (anhance (50° provide for each well) with past montainer and basis brace	ļ				10 00						
	Valves and fittings for each row of soung	Ì	0			10.00 10.00						
SVUBrevent Wate	Beauparge treatability but			2,200.00		10.00						
21 COMMEN MED	Well motalization (20 feet, 4" insurant, Pr.C. organ september made. Transfering to fan henne (50: 2" dress over ops for each well, mich, hennelle)	}			,	10.00						
	Markele with core term per well.		ة ا			10.00						
	Point to furthers (50° Private for such well) with pay moutables and best trace		ه ا			10.00						
	Valves and Entergs for each ran or many	i	0	150.00	LS	10.00						
	Aughoit surface cover to minute start-cureating and product money from writte	i	0	6.47	st	10.00						
	Between treatmenty text			10,000.00		10 00						
SVE/Sparge Fan Heuse	Prefab Nouseq	W	0			\$0.00						
	Injection blower					10 00						
	Water separates	ł	! !	1,293,00 1,293,00		10.00						
	Must allowerer Outs he ster		;	2,133.45	1	10.00 10.00						
	Estraction Money		۱ ،	9,051.00		10 00						
	Condustrie receiver	i	1 .			10.00						
	Unit heater	1	ا	523.67		10.80						
	Door leaver with lard screen	1	٥	27.80		10 00						
	Exhaust Controls	Ī	0	10,344.00	1 1	10.00						
	Instrumentation (pressure, flow)	1	0	4,848.75		10.00						
	Sampling parts	1	0	387.90	1 1	10.00						
	Plumburg and electrical healt as		٥	1,000.00		10 00						
	Equipment controls Electrical basis sin	i	0	2,876.93 1,000.00		10 00 10 00						
	Lightong	i	۱	280 42		:0.00						
LTTD Treatment	1/170 processing (expanded vanish)		-	96.94		10.00						
	Exception (a) place volume)	,	o	2.55		10.00						
	Haufing excession terfron treatment faculty (expenses volume)		0	5.25		10.00						
	Confirmatory and sample provinces excession years, I sumple 200 CT excession	ŀ	0	300.00		\$0.00						
	Trestability testing	i	σ	5,000.00	1	10 00						
	Backfill treated and an original excellenters (expansed volume)		0	2.57		10.00						
	Dispuse of trested see at PN landed responded waters.	ľ	0	0.00	l i	10.00						
	(import & baciful clean ful if dissume of greated seds at PM landful expended volume)		0			10 00						
Capping	Cap gestall	4.4	0	1.19		10.00						
Solidification (portland coment)	Max design treatments testing	İ	0	35,000.00 2.55		10.00						
	Excuration (in place venium) Mixing, placem	1	0	2.55 193.95		10.00						
		1 1			10.							
	1 Confirmations and appears managers, extraordiscounts, 1 country, 200° (7 accounts of)	1	0	E00 00	i	1000						
Francis Pde Acute	Confirmations and assess arentees excurrence (rest, 1 servers 200 CT excurated) [Excuration (in place valuable)		0	\$00.00 2.55		10.00						
Engraverse Prio-Bropsia	Confirm story unil apresso enversor: exceptates creats, 1 savetes 200 CT exceptatif) Exceptation (on place velocitie) Construction and successors	4.4	0	\$00.00 2.55 32.33	CY	\$0.00 \$0.00 \$0.00						
Engineersa Pife-Biopsia	Excension (in place velocity)	W	0	2 55	C7	10.00						
Engineer se Prin-Buquis	Elevation (in place vehicle) Construction and systemati	HA.	0	2 55 37.33	67 67	10.00 10.00						
Engineeres Pde-Buspis Engineeres Pde-SVE Pde	Elementus (de place estados Construction and treatment Translability testing	HÁ NA	0	2 55 37.33 10,000.00 300.00	2 E E E	10.50 10.00						
	ELECTROSCO (IN place religion) Construction and treatment Translability testing Confirmatory (and seamed emphysical- excuration (resid, 1 samente 20C CT excursted) ELECTROSCO (IN place religion) Carestrosco (In place religion)		0	2 55 32.33 10,000.00 300.00 2.55 32 33	228622	10.50 10 00 10 00 30.00 10.00						
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CY: cable yard

1/10: New temperature thermal decent NA: next applicable for the atternature PVC: pelyvenyl chleride ST: square feet SY: capmen yard SVE: sell vapor extraction

er: ends FW: Furt Waisseright

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 2 Institutional Controls and Natural Attenuation

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to L	mplementation	0					
	Administration and supervision		40	85.00	hr	\$3,400	
	Design and development		80	75.00	hr	\$6,000	
!	Drafting	i	32	65.00	hr	\$2,080	
	Monitoring and testing (Year O)		0	65.00	hr	\$0	
	Project engineering		24	65.00	hr	\$1,560	
Subtotel							\$13,040
Engineering : Decommis	sioning	30					
	Administration and supervision		20	85.00	hr	\$1,700	
	Design and development		40	75.00	þr	\$3.000	
	Drafting		8	65.00	pt	\$520	
	Monitoring and testing	ļ	0	l	1 1	\$8	
	Project engineering		40	65.00	hr	\$2,600	
Subtotal							\$7,820
License/Permit/Legal	(10% engineering costs)	0	1	2,086.00	ea	\$2.086	\$2,086
Start-up and Shake Dow	n of Treatment System	NA NA				·	_
	Materials		0	1,000.00	ea	\$0	
	Labor		0	65.00	þr	\$ 0	
	Equipment		0	1,000.00	ea	\$0	
	Lab Testing		0	500.00	ea	\$0	
Subtotal							\$0
Contingency	(15% capital costs)	0	11	5,349.90	LS	\$5,350	\$5,350
							
Total	Year	0	İ				\$20,476
	Year	30			1		\$7,820

ea: each

hr: hour

IC: indirect capital cost

LS: Jump sum

NA: not applicable for this alternative

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.2 Institutional Controls and Natural Attenuation

Annual System Operation Cost Detail

	Item	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totalvear
Operating Labor Cost					1/Year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 30	\$2,600
	Item 2: Training	1	200.00	LS		1 to 30	\$200
Subtotal							\$2,800
Routine Maintenance N	Naterials and Labor Cost				1/Year		}
	Item 1: Groundwater monitoring annual maintenance] 1	1,000.00	LS		1 to 30	\$1,000
	Item 2: SVEJair sparge well annual martenance	0	l	LS	1		\$0
	Item 3: Sampling field kit	2	75.00	day		1 to 30	s 150
Subtotal							\$1.150
Auxiliary Materials and	Energy	 		_		NA NA	
	Process Chemicals] 0		LS]		+10
	Electricity) 0	ļ	LS]		\$0
	Water	O.		เร			\$0
	Sewar	0		ιs	1		\$0
	Fuel	0		LS	<u> </u>		\$10
Subtotal							\$0
Disposal of Residues				_	1/Year		
	Wash water, sludge, ect.]1	500.00	LS		1 to 30	\$500
Subtotal							\$500
Purchased Services		<u> </u>		_	1/Year		
	Professional Services						
	Item 1: _acoratory fees	8.	625.00			1 to 30	\$5.000
	Item 2:	0		Ł\$			\$0
	ltem 3:	0		LS			\$0
Subtatal					1 1		\$5,000
Other:					1/Year		
	t included in other line Items	0		LS			\$0
insurance		0	0.00				\$0
Taxes, licensing, permit] 0	0.00	LS	j j		\$0
Maintenance Reserve Fi	*** *						
	rated for each year of implementation)		68.36	LS		1 to 30	168
Subtotal							\$68
Total Annual Operatin	n Cost					1 to 30	19.518

Number of years of implementation:

30

AOC: annual operating cost fur: hour LS: lump sum NA: not applicable for this alternative SVE: sod vapor extraction

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Direct Capital Cost - Detail

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Totals Year 6 11.818,592,60	Engineered Pilo-SVE Pilo Landfarmong Montering Well Installation Economics Shoring Fancing and Sign Pactray Fancing and Sign Pactray Fancing and Sign Pactray Fancing and Whater Economics Decembersbecame at Implementation Outposes into sport Sed at Fart Wildenswight Landfel	Compression and treatment Treatablify testing Construction and environment Literatum in-piace volumes Literatum in-piace volumes Construction and environment Construction and environment Construction and environment Construction and environment Treatablify testing Confirmatory and sample environment Construction environment Construction environment Construction and environment Treatablify testing Construction environment Construction environment Construction environment Construction Treatablify testing Construction environment Construction Const	NA NA 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.55 2.53 10,000,00 2.55 22.33 10,344 00 5.000.00 2.55 9.70 5.000.00 2.55 9.70 5.000.00 2.950 00 2.950 00 2.950 00 2.950 00 2.950 00 10.00 10.00 2.950 00 2.950 00 2.950 00 10.00 2.950 00 2.950	07 07 15 15 15 15 15 15 15 15 15 15 15 15 15	10.00 10.00
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LTTD: low temperature through decorption
RA: set egelicable for this eternative
PPC: payme charide
SF: payme pard
SYI: payme yard
SYI: set representation

es: each PM: Furt Wais

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Indirect Capital Cost Detail

	hem		Year of IC Expenditure	Quantity	Rate	Units		Cost
Engineering: Design to Ir	mplementation		0		}			
	Administration and supervision			320	85.00	hr	\$27,200	
	Design and development			640	75.00	р	\$48,000	
	Drafting			240	65.00	hr	\$15,600	
	Monitoring and testing (Year O)			0	65.00	μ	\$0	-
	Project engineering			280	65.00	lyr	\$18,200	
Subtotal								\$109,000
Engineering : Decommis	sioning		15					
	Administration and supervision			60	85. 0 0	lτ	\$5,100	
	Design and development			160	75. 00	ħr	\$12,000	-
•	Drafting			40	65. 00	hr	\$2,600	
	Monitoring and testing			0	65.00	hr	\$0	
	Project engineering			138	65. 00	hı	\$8,970	
Subtotal								\$28,670
License/Permit/Legal	(10% engineering costs)		0	1	13,767.00	ea	\$13,767	\$13,767
Start-up and Shake Dow	n of Treatment System		0					
	Materials			6	1,000.00	22	\$6,000	
	Labor			240	65.00	hr	\$15,600	i
	Equipment			6	1,000.00	ea	\$6,000	
	Lab Testing			48	500.00	ea	\$24,000	
Subtotal		ı						\$51 .600
Contingency	(15% capital costs)		0	1.	226,142.41	LS	\$226,142	\$226,142
7 1								4400 500
Total		Year	0	ļ				\$400,509
		Year	15					\$28,670

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.3 Soil Vapor Extraction, Groundwater Air Sparging and Monitoring

Annual System Operation Cost Detail

	Item	Quantity	Rate	Units	Frequency	Yearts) of AGC Expenditure	Totaliyear
Operating Labor Cost					llyear		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr	(1 to 15	\$2,600
	Item 2: SVE/AS system monitoring	208	65.00	hτ	}	1 := 10	\$13,520
	Item 3: Training	1	400.00	LS		1 to 15	\$400
Subtotal						1 :0 15	\$3,000
		<u> </u>				1 to 10	\$13.520
Routine Maintenance Ma	terials and Labor Cost	T			1/year		
	Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS		1 to 15	\$1,000
	Item 2: SVE/air sparge system annual maintenance	1	1,000.00	LS		1 to 10	\$1,000
	Item 3: Sampling field kit	2	75.00	day		1 to 15	\$150
Subtotal						1 to 15	\$1,150
					1	1 :0 10	\$1,000
Auxiliary Materials and E	ner nv			_	1/year		T
, maranas pilo s	Process Chemicals	1 0	•	LS	[]		\$0
	Electricity (Phase 1)	1	152,000.00	ı		1 to 3	\$152,000
	Electricity (Phase 2)	1 1	14,200.00	•		4 to 10	\$14,200
	Water		, 200.00	ıs		7.0.0	\$0
	Sewer	0		rs]		30
	Fuel	1 1	400.00		1	1 to 15	\$400
Subtotal	100	 	100.00		<u> </u>	1 to 15	5400
000.012/		1		1		4 to 10	\$14,200
				ĺ		1 to 3	\$152,000
Disposal of Residues		+		-	1/year		1
DISPOSES OF TRESIDUES	Wash water, sludge, ect.	} ,	500.00	ıs	.,,,,,,	1 to 15	\$500
Subtotal	Trasii Water, Sibbye, ect.	 	300.00	-		1 to 15	\$500
00010187						. 10 . 5	
Purchased Services					1/year		i —
Professional Service	es						İ
	Item 1: Laboratory Fees	8	62 5.00	weii		1 to 15	\$5,000
	Item 2: Engineer review/ consultation	12	130.00	month		1 to 15	\$1,560
	Item 3:			LS	1		10
Subtotal		1				1 to 15	\$6,560
		<u></u>		L			<u></u>
Other:					1/year		
Administrative costs not i	ncluded in other line items		ì	LS	1		\$0
Insurance		0		l\$			\$0
Taxes, licensing, permit re	enewal	0	ļ	LS			\$0
Maintenance Reserve Fun	d		1				1
15% of capital costs or	orated for each year of implementation	1	5.779.19	LS		1 to 15	\$5.779
Subtotal						1 to 15	\$5,779
		 					
Total Annual Operating	Cost (includes GW Monitoring)		- {			1 to 3	\$183,909
·			[4 to 10	\$46.109
			ľ			11 to 15	#17.389
Groundwater Monito	nring Portion Of Total AOC					1 to 15	\$8,600

Number of years of implementation:

15

AOC: annual operating cost AS: air sparge hr: how LS: lump sum SVE: soil vapor extraction GW: groundwater

Fort Waimwright OU-2 Feasibility Study Baseline Cost Estimate - ORMO - Alternative No. 4 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Waimwright Landfill

Cerect Captus Cast - Detail

	Stem	Year of DC Expenditure	Chamber	Raza	<u> </u>	Tetal
SpargerBussarge drain	Well installation 50-feet, 1-1/4" dementer, struct cross, directs weeks)	•	62	1,486.95		195.1
	Trenching to fan history (50°, 2° deep- everage for exich weld, sticl. becaffe)		62	120.25	1	17 4
	Marinale anth cover (one per well)		62	648.50	1.	144.8
	Printing to ferhouse (50° average for each well with pape destination and heat times		62	850.15	1	1927
	Valves one fittings for each run of points		62			12.3
	Bicopurgo trestatility tast	ļ	0		1	1
SVE/Breveat Mails	Well instruction (20 feet, 4" diameter, PVC, anger representation media)	3	21			146.2
	Trenching to fan bouse (50°, 2° deep everage her each well, excl. becitfill-		21	120.25		125
	Markele with cover (and per well)		21	646 50		11111
	Printing to fundament (50° average for each well) with pape dissistant and least trace	i	21			1173
	Valves and Stongs for each not of popula		21	150.00	1.5	121
	Asphalt surface cover to measure short caresting and protect pupping from 8 of Sci.	ł	25,000			טונו
	Biovent treatminty cert		0	10,000.00	r2	i
SVE/Sparge Fan neuse	Prefab housing	0	10	5,000.00	111	154.1
	Importage become		10	9.051.00		198.5
	Water separatur	Į.	10	1,293.00		112.1
	Mist dimension	J	10	1,293.00	J	112.5
	Duct heretor	!	10	2,133.45		:21.3
	Estraction Minner		10	9,051.00		:98.5
	Continuate receive		10	1,293.00		1121
	Unit heater		10			-15.2
	Deer loover with hird screen		10	27 80		12
	Exhaust Contrais	ł .	10	10,344.00		1380.6
			10	4,848.75		148.0
	Instrumentation (greature, floor)		10	387.90		12
	Sampling ports		10	1,000.00		1111
	Phataling and electrical book as					171
	Equipment controls		10			
	Electrical hone-en	[H
	Lightong	<u> </u>	10	200.42		:21
TTD Treatment	LTTO processing (expanses visitate)	MA	0	96.98		1
	Exception (in-place volume)		0	2.55		l
	Handing accession to/both treatment facility (expanded vehicle)	1	0	5.25		ŀ
	Configurações poi sample analytical-ascaretore linate, 1 samples 200 CT escaretade	1	D,	300.00		
	Treatability testing		O.	5,000.00	LS	
	Backfill treated and in original excessions recommed statemes		01	2.57	Cr	
	Dispase of treated and as FW landful (expenses volume-		0	0.00	a	
	loopert & backful clean fill of dispuse of treatmit scale at 19th tanaffill lespension ornames	1	0	2.99	ler l	
42940	் மேற் அரபுக்	NA.	0	1,19		
ichidhtation (portland tament)	Miss data greatestable y testing		- 0	35,000.00		
	Excellente in-later Approxis		0	2.55		
			ő	193.95		
	Mixing, placing		ő	600.00		
	Confirmatory and symple qualytical- excention (rect), 1 summin 200 CT escential					
representative Para Granus	Exchangement (to lease approximate)	- W	0	2.55		
	Company and transferent		이	32.33		
	Treatablify (esting		0	10,000.00		1
	Confirmatory sell sample (malyocal- excession treats, 1 commits 200 CT excessed)		0	300.00	1 .	
Communities Sell Fee	Elichistria (a-mace ventual)	N.	0	2.55		
	Construction and treatment		0	32 33		
	Office treatment dust		0	10,344.00		
	Trestability testing		0	5,000.00	ls	
	Confirmatory sell sample analytical-excession inicit. I complex 200 CY excessed		0	300.00	- 1	
indfarming	(1 Cayatran in crack value)	NA.	0	2 55	CY	
	Construction and treatment		0	9 70	CT	1
	Transation resona	ı j	0	5,000.00		
	Confirmatory seri a propie approprie azcovatori (rusti. 1 summer 200 CY estavatori		0	300 00		
entering that defaulties	Well instanation and development (25-feet, 4" & american Ph.C. augus fra-normos makes	3	- 7	2,950 DO	_	16.3
COVIDER Shorter	Shoring installation and regional at women to destro at 12 fact	ù		27.80		_
nong are Sign Ferrang	6 four chain une with high-visibility signa	NA.	0	16.47	_	
erana ter Wester : 15540000	Promoute for worker excavapon (Building 1163 love-water as worker)	NA.	0	2.55		
COMMUNICATION & MANAGEMENT	Mentor well	0		220.00		: ' 5
	Permanentry autoficial probe		32	110 00		- 11
spess not spot son al	Escayadan (an place yolung)		1,900	2.55		- 14 8
ri Wanungiri Ladilik	Hading excension to Fort Wainwright Londfill Ferpandon volumes		2,280	5.25		1113
	Despecial (assumented Volume)		2.280	0.00		
	Confirmatory and suspin enalytical-escentism (rest, 1 parties) 200 CY escentism	ľ	10	300.00		illi
	impart and place chain fill (expanded veloces		2,280	2.99	CY	:63
CONTRACTOR OF	Well (marriages, SVE, or sparge) remove	15	110	220.00	-	1742
d of Cleamp Actors	Permanently exitated probe removal	Į.	ol	110.00		
•	Underground piping removal, transh beciffit, had and dispuse at PW laudilli		5,000	2.00		1744
	Engineered printerior deconstruction and stretiging prestant and	ľ	ol	10.00		
	Hading treated seil to placement area		اه	5.25		
	First house documentationship and removal		10	1,700.00		117,8
	Sito nestoration	i	.,1	10,000,00		116.0
	Conformatory and sample analytical	l	15	620.00		HJ
			148	940.00	- 1	• 16.4
ais	Tau				\rightarrow	\$1,837.6

CY: collic yard DC: direct countel cost

NA: not applicable for this alternative NA: not applicable for the PVC; polyvinyl chloride SF: square foot SY: square yard SVE; soil vapor extraction

LTTD: few temperature thermal des

FW: Fort Wass le: hour LF: linear foot

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 4 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

Indirect Capital Cost Detail

	ltem	Year of IC Expenditure	Cuantity	Rate	Units	<u> </u>	Cost
Engineering: Design to 🗈	nolementation	0					
	Administration and supervision		320	85.00	þι	\$27,200	
	Design and development		720	75.00	hr	\$54,000	
	Drafting		288	65.00	hr	\$18,720	
	Monitoring and testing (Year Q)		0	65.00	pt	\$0	
	Project engineering		640	65.00	hr	\$41,600	
Subtotal							\$141,520
Engineering : Decommiss	coning	15					
	Administration and supervision		80	85.00	hr	\$6,800	
	Design and development		150	75.00	μι	\$12,000	
	Drafting		48	65.00	hr	\$3,120	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering		120	65.00	hr	\$7,800	
Subtotal							\$29,720
License/Permit/Legal	(10% engineering costs)	0	1	17,124.00	ea	\$17,124	\$17,124
Start-up and Shake Dow	n of Treatment System	0					-
	Materials		6	1,000.00	82	\$6,000	
	Labor		240	65.00	hr	\$15,600	
	Equipment		6	1,000.00	ea	\$6,000	
	Lab Testing		48	500.00	ea	\$24,000	
Subtotal							\$51.600
Contingency	(15% capital costs)	0	1	202,213.35	LS	\$202.213	\$202,213
Total	Year	0					\$412.457
	Year	15			1		\$29,720

ea: each

hr: hour

IC: indirect capital cost

LS: tump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No.4 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and Disposal at the Fort Wainwright Landfill

Annual System Operation Cost Detail

	Item	Quantity	Rate	Units	Frequency	Year(s) of AOC Expenditure	Totallyear
Operating Labor Cost					1/year		
(Post-Construction)	Item 1: Groundwater monitoring	40	65.00	hr		1 to 15	\$2,600
	Item 2: SVE/AS system monitoring	208	65.00	hr		1 to 10	\$13,520
	Item 3: Training	1	400.00	LS		1 to 15	\$400
Subtotal						1 to 15	\$3,000
		_1		L	<u> </u>	1 to 10	\$13.520
Routine Maintenance Ma	Iterials and Labor Cost	1			1/year		
	Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS	l	1 to 15	\$1,000
	Item 2: SVE/air sparge system annual maintenance	1 1	1,000.00	LS		1 to 10	\$1,000
	Item 3: Sampling field kit	2	75.00	day	1	1 to 15	\$150
Subtotal		1				1 to 15	\$1,150
				<u> </u>		1 to 10	\$1,000
Auxiliary Materials and E	nergy				1/year		T .
	Process Chemicals	0		LS	ľ	1	\$0
	Electricity (Phase 1)	1 1	152,000.00	LS	ł	1 to 3	\$152,000
	Electricity (Phase 2)		14,200.00			4 to 10	\$14,200
	Water	ا	,	LS	Ì		\$0
	Sewer	ď	'	ıs	ł		\$0
	Fuel	1 1	400.00	1		1 to 15	1400
Subtotal	rua	+	400.00	-		1 to 15	\$400
30010181				l	ŀ	410 10	\$14,200
					1	1 to 3	\$152,000
Circuit of Board or		+		 -	11	7103	1 77.2.000
Disposal of Residues	Week a star of decrees	1	500.00		1/year	1 16	4500
	Wash water, sludge, ect.	<u>1</u>	500.00	12		1 to 15	\$500
Subtotal		1 1		İ	ĺ	1 to 15	\$500
Purchased Services		$\overline{}$			1/year		
Professional Servic	es]		ļ
	Item 1: Laboratory Fees	8	625.00	well	1	1 to 15	\$5,000
	Item 2: Engineer review/ consultation	12	130.00	month		1 to 15	\$1,560
	Item 3:	1 0		LS			\$0
Subtotal	····	1				1 to 15	\$6,560
		<u> </u>					<u></u>
Other:					1/year		
	included in other line items	이		LS			\$0
nsurance		0		L\$			\$0
Taxes, scensing, permit re		0		LS			\$0
Maintenance Reserve Fur	nd .]
(5% of capital costs pi	orated for each year of implementation)	1	5,167.67	LS		1 to 15	\$5.168
Subtotal						1 to 15	\$5,168
		 					
Total Annual Operating	Cost (includes GW Monitoring)					1 to 3	\$183,298
	•	1 1				4 to 10	145,498
						11 to 15	\$16,778
Groundwater Monite	oring Portion Of Total AOC	1 1				1 to 15	\$8,600

Number of years of implementation:

15

AOC: annual operating cost AS: air sparge ea: each hr: hour SVE: soil vapor extraction GW: groundwater

Fort Waisswight OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 5 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

Direct Capital Cast - Detail

	цы	TEST OF DISTRIBUTED OF	COSTOLIA	744	7.00	1942
Secreto Besseryo Wells	Hell installeton (50-fast, 1 1/4" donnter, trace eye, deven wells)	0	62	1,484.85	· -	192,190
	Transching to fan house (50°, 2° does- overage for each well, seci. backfill)	J .	62	120 25	5 -	17 455
	Marghado surch cover (man per soul)		62	\$46.50) 	140 083 1
	Paper to furtheres 50° everage for each wolf- unto pape conduction and least trace	,	62	ISO 15	i	±52,709.
	Yahes and fittings for each not of some	i	\$2	150 00) 	19,300
	Becomer per translation ty tent		3	18,000.00	-	10.
21 C Between Wells	Half restallation (20 her), 4 - diameter, Fr. Lague representation reside)	U	ζ.	7,235 W		: 46.200
	Trunching to fan house (50°, 2° doop- overage my cases well, incl. hectfill)	ì	21			12.5 25
	Machale with cover time per well)		21			113,576.
	Figing to forboars (50° provings for seco well; with more mondation and heat trace	į	21	1		117,853.
	Yahas and fittings for each ran of some		21			\$3,150.0
	Applicate perfects cover to company others correcting and protect piping from traffic		25,000			· 1211,750+
	Descent treatmints test)	10,000.00	1	10.
211, Sourge Fait House	Frei de Toncomo			3.700 00		120.000
	lepaction Money		10			190,510
	Water separatur		10			112,930.
	Met dimental		10			J12,930.
	Duct heater		10			121,334.
	(reactes Messe)		10			190,510,
	Condensate recurrent		10			112,930 15,236
	Unit tenter	1	19			1270
	Dear leaves with hird terrors		10			1103,440
	Exhmest Controls Instrumentation (procupes, flows)		19			148,487,
	Sampling parts		10			13,879.
	Sampling and electrical hook-up		10	1		110,000.
	Eminate canage		15			128,769
	Enctrical head-up		: 2	1		110,000
	Lighten		12	220 42		12,004
Ireacount	[LTTD processing (expended volume)	NA NA	-	20 28	CT .	107
	Excerption (in-place volume)		3	2 55	CT	10.0
	Happing or coverage to large treatment facility (expenses volume)		C.	5.25	CY	\$0 (
	Conferentery and a sergie metrocal- or correge urers. T sample 200 CY excepted		0	300.90	-	10.0
	Tracking turns		0	5,000 00	i us	101
	Backfil tracted and in griginal excessions recognised websited		. 0			10 (
	Dispose of treated and at PW bookfill (expension reduction		3	8.00		10 (
	impart & backfill clean fell of dispase of treatest sens at PW handfill (expended volume)		Q	2.99		10 (
	Cap install	MA		7.15		101
Sendification (portrant coment)	Mes descript treatministy leasting	0		15.600.00		135,000,0
	Exception (in-place volume)		1900			14,845,0
	Mixing please)		27.50	193 95		1442,206.0
	Conference unit sample graphytical- excernition trace. 7 sample/200 CY excernited		::	300.00 7.35		13,000.0
:ngmer of Pde-Bapile	Exchange (n-breco Agrana)	NA.				103
	Construction and trestment		3	10,000,00		10.0 10.0
	Treatability testing Confirmatory sell sample projytecut- exceedings urant, 1 sample/200 CY exceeded		٥	300 80		10.0
Lagrange of Pds SVE Pds	Licensian in place values:	NA NA		200 00		101
Commenced Legs 74.6 Legs	Construction and treatment	· •	'n	17.33	1	100
	Office tractment and		5	18,344 00		100
	Trestability turbos		0	5,900 00		10 (
	Confirmatory and comple qualifical- excession urgals, 1 comple/200 CY excession		c	306 00		10 (
Land or Hong	Exception (in page visual)	- NA		7.35	_	101
	Construction and treatment	· ·	3	9.70		10 0
	Treatebalere testang		9:	5,000 90		10 (
	Confirmatory sell sample proprietal exceptions trans. I sample/200 CV exception		0	300 00	(-	10 (
Maintering Wall histollation	Will appallation and development (25-line, A. Gammar PVC major rig-vistated entiti)			Z 200 00	=	15.900
: I movetion Shares)	Shoring installation, and removes in women to counts of its feet	NA.	- :	27 80	LF .	101
encate and Sign Pesting	b Tool Chase limit with high-visionaty Jugar	NA NA		· ÷ 4/	(F	101
weem ler Wester Excavation	Prantom for contin excavation (Building 1) to one-maker in contine	NA_		1.55	UT_	101
-ecommotherine at publishmentation	Months and	U	-	273.00	=	11,540 (
	Persumently established probe		33	110 00	-	13,520
Josephson High-spoin Scal at	Escavation (in-place villame)	NA		7 35		10,0
for Namurajii (andfili	Hading exception to furt Wainsright Landid (expanses volume)	ľ	31	5 25		10 0
	Disperal (aspended Volume)		9	0.00	i - I	10 (
	Confirmatory and sample analysical excessions orano, 1 sample/200 CY excession		31	300 00		10 (
	lapper and place clean fill (expanded vacuum)			2 39		10 (
recommutationing of End of Cleanup Action	Well (menturing, SVE, or spirige) recovers	15	162	227 00		172,8403
	Personantly as tarked prote removal	15	أنسي	110 00		10.000 110.000
	Undergreed paint recent, treet install, test are depose at PM testfill	13	5,000	2.00 10.00		
	Engineered phylipselform documentectum and executating process and		:1	5.25		10,0 10,0
	Huding treated and to placement area	15	10	1,700.80		117,000,0
	Fan lause decommissipality and removal Site restaration	15	.,,	19,000 00		117,000,0
		15	15	626.00		12,300.0
	Confirmatory estimated and sample analytical Confirmatory and assembly expectations reported and a complete COO CV reported and a	30	':'	220.88		11,760,0
- [44]	Confirmatory and sample analytical-trained texts (1 sumple/200 CY trained and) Year	- 30 -		220.00	=	\$1,760,0 \$1,496,043,1
	Your	15	ļ		ı I	11,456,943,1 168,748,1
	Year	30	ı			61.760.0

CT: calife yard DC: direct capital cost

LTTO: how temperature thermal descrition
RA: not applicable for this afternotive
PTC: polymort obtains
ST: spanse four
ST: spanse yard
SVE: sed vapor extraction

or, much RP Fort Walnunght for large LF factor fact LS, large sun

175

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 5 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

Indirect Capital Cost Detail

	Item	Year of IC Expenditure	Quantity	Rate	Units	<u> </u>	Cost
Engineering: Design to In	nplementation	0					
	Administration and supervision		360	85.00	hr	\$30,600	
	Design and development		800	75.00	hr	\$60,000	
	Drafting		336	65.00	hr	\$21,840	
·	Monitoring and testing (Year O)	Ì	65	300.00	ea	\$19,500	
	Project engineering		560	65.00	þr	\$36,400	
Subtotal							\$16E.340
Engineering : Decommiss	ioning						
	Administration and supervision	15	80	85.00	hr	\$6,800	
	Design and development	15	160	75.00	hr	\$12,000	
	Drafting	15	48	65.00	hr	\$3,120	
	Monitoring and testing		0	65.00	hr	\$0	
	Project engineering	15	120	65.00	hr	\$7,800	
	Project engineering	30	80	65.00	hr	\$5,200	
Subtotal						Year 15	\$29.720
						Year 30	\$5.200
License/Permit/Legal	(10% engineering costs)	0	1,	20,326.00	ea	\$20,326	\$20. 32 6
Start-up and Shake Dow	n of Treatment System	0					
	Materials		6	1,000.00	ea	\$6.000	
	Labor		240	65.00	69	\$15,600	
	Equipment		6	1,000.00	ea	\$6,000	
	Lab Testing		48	500.00	ea	\$24,000	
Subtotal							\$51. 600
Contingency	(15% capital costs)	0	1	276,259.47	LS	\$276,259	\$27E.259
	Year	0	'				1516.525
Total	Year	15					\$29,720
	Year	30					15.200

ea: each

hr: hour

IC: indirect capital cost

LS: lump sum

Fort Wainwright OU-2 Feasibility Study Baseline Cost Estimate - DRMO - Alternative No. 5 Alternative 3 Plus Excavation of Surface Soils Containing Benzo(a)pyrene and On-site Solidification

Annual System Operation Cost Detail

Item	Quantity	Rate	Units	Frequency	Yearls) of AOC Expenditure	Totallyear
Operating Labor Cost				1/year		
(Post-Construction) Item 1: Groundwater monitoring	40	65.00	hr]	1 to 30	\$2,600
Item 2: SVE/AS system monitoring	208	65.00	hr		1 to 10	\$13,520
Item 3: Training	1 1	400.00	LS		1 to 30	\$400
Subtotal					1 to 30	\$3,000
			l		1 to 10	\$13,520
Routine Maintenance Materials and Labor Cost				1/year		
Item 1: Groundwater monitoring annual maintenance	1	1,000.00	LS		1 to 30	\$1,000
Item 2: SVE/air sparge system annual maintenance	1	1,000.00	LS		1 to 10	\$1,000
Item 3: Sampling field krt	2	75.00	day		1 to 30	\$150
Subtotal					1 to 30	\$1,150
					1 to 10	\$1,000
Auxiliary Materials and Energy	7		_	1/year		
Process Chemicals	0		LS			\$0
Electricity (Phase 1)	1	152,000.00	LS]	1 to 3	\$152,000
Electricity (Phase 2)	[1	14,200.00	ιs	1	4 to 10	\$14,200
Water	0		LS			\$0
Sewer	0		ιs	1		\$0
Fuel	-{ i	400.00	ίs	[1 to 30	\$400
Subtotal					1 to 30	\$400
			l		4 to 10	\$14,200
	1 :		ĺ	!	1 to 3	\$152,000
Disposal of Residues				Tiyear		
Wash water, sludge, ect.	1 1	500.00	LS],	1 to 30	\$500
Subtotal					. 1 to 30	\$ 500
Purchased Services	1			1/year		
Professional Services	1 1			}		l
Item 1: Laboratory Fees	8	625.00	well		1 to 30	\$5,000
Item 2: Engineer review/ consultation	12	130.00			1 to 30	\$1,560
Item 3:			LS			\$0
Subtotal	1		_		1 to 30	\$6,560
Other:				1/year	<u> </u>	
Administrative costs not included in other line items	0		ιs			
Insurance	0		LS			
Taxes, licensing, permit renewal	0		LS			
Maintenance Reserve Fund						
15% of capital costs prorated for each year of implementation	1	3.529.98	LS		1 to 30	\$3.530
Subtotal					1 to 30	\$3,530
	+					
Total Annual Operating Cost (includes GW Monitoring)	1 1	ſ		İ	1 to 3	\$181,660
	1 1				4 to 10	143,860
	1		- 1	J	11 to 30	\$15,140
		ļ				
Groundwater Monitoring Portion Of Total AOC	1 1				1 to 30	\$8,600

Number of years of implementation:

30

AOC: annual operating cost AS: air sparge hr: hour LS: hamp sum SVE: soil vapor extraction GW: groundwater